THE RAILWAY REVIEW

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Which Side of an Oak Tie to Lay Down.—Referring to a query in the Engineering News of July 23, as to which side of an oak tie should be up when laid in a dirt road-bed, one side having full face and the opposite side having corners rounded off, a writer to that journal says the rounded side should generally be placed up. Such a tie is frequently made from a tree large enough to make two ties to an 8 ft. section of the trunk, or what is commonly called a "split tie." If laid with the rounded side up, the grain of the wood will have a tendency to shed the water, whereas if laid with the full face, or heart side, up, the grain will tend to carry the water to the center of the tie. There would be probably at least ½ in. of sap at the rounded corners, and if placed down it will commence to rot quicker than if turned up; for in the latter position it will stand a better chance to dry out after rains. The full face side down will also hold better in the tamping. The rounded side will not give as good bearing for the rail, but in a dirt track it is fair to assume that the traffic is not heavy, consequently there will be no serious cutting of the rail into the tie.

Facts About the New Soo Lock.—The new 800-foot lock at Sault Ste. Marie was officially opened by the revenue cutter Andrew Johnson, and the harbor improvement steamer Hancock locking through 10:30 a. m., August 3. Work on the lock was commenced on May 4, 1887, when the first dipperful of earth was excavated for the cofferdam. Dimensions of the new lock are 800 feet long, 100 feet wide and 21 feet deep. The side-walls are 1,100 feet long. From the east end for 282 feet the walls are 45 feet high, and from that point westward they are 43 feet high. The walls are 20 feet wide at the base and retain this width for 10 feet, when by five two-feet offsets five feet apart they are narrowed to 10 feet in width. At either end the walls are 36 feet wide from base to top. The cut stone for facing is of the best Kelley-island limestone, and was transported here in the rough. The faces of the lock wall consist of 23 courses. From courses 2 to 22 the stones were cut six feet long, three feet wide and two feet thick, part of the first course and the capping course being 1½ feet thick. The cost to the United States for the masonry was $1,085'469. In the basement of the power-house is situated two 30 horse-power turbines, which will drive three three-plunger single-acting high pressure pumps that will deliver pressure fluid to loaded accumulators, where it will be stored under pressure of 300 to 500 pounds per square inch, ready for use, and delivered to engines as required. The exhaust, or discharge, from the engines will be returned by means of a separate set of piping to a tank in the engine-room and used continuously. The pressure fluid will be a limpid mineral oil, and will be used during the entire season. This will be different from the present lock, which uses water pressure in the summer and oil during the cold weather. The lock chamber can be filled and emptied when in operation in from six to seven minutes. Water is let in through six culverts, which run longitudinally under the lock floor. In connection with the lock, there is under construction a magnificent office and power building of cut stone and brick, which will be completed in December. It is 81 ft. 6 in. long and 80 ft. 9 in. wide, and will cost approximately $100,000. In the basement is located the operating machinery and pumping plant. Including the approaches, the great work completed will cost in the neighborhood of $5,000,000. The work was begun under the supervision of the late Col. O. M. Poe, who lived to see the great undertaking practically completed. Gen. Supt. E. S. Wheeler had active direction of the work.—[Marine Review.

Adhesion of Iron to Concrete.—A test of the adhesion of concrete to iron has recently been made in connection with a piece of concrete and iron construction now going on in Milwaukee, Wis. A block of concrete, 16x3x4 ins., with a 1-in. square bar of twisted iron passing lengthwise of it was heated to a red heat for about 20 mins. in a furnace, and was then plunged into a bath of cold water until it was cooled throughout. Upon removal the concrete was found to be somewhat soft and friable, but it soon became hard again. There were no signs whatever of any separation of the iron from the concrete nor was the concrete cracked along the line of iron bar or anywhere else. The least depth of the iron from the surface of the concrete was about 1 in.

Ice for Section Men.—A railroad that neglects to furnish ice to its section men these hot days pursues a very short-sighted policy, says Jerry Sullivan in Roadmaster and Foreman. No man can do the amount of work he is capable of doing unless supplied with water that is at all times cool and refreshing. Each section gang is usually furnished a keg, which they fill with water in the morning, but in a short time it gets warm and insipid, and by the time the sun begins pouring down its hottest rays and the men are dripping with sweat from their exertions the water becomes absolutely sickening. The train men, operators, clerks, agents are all supplied with ice water, although the sun never shines on them while on duty, yet the men who bear the heat and burden of the day are compelled to drink water that even a Pullman porter would "gang as haughtily by it as I wad by a stinking brook" (apologies to Burns). It is a common occurrence to have one or two men out of a section crew ill for several days after drinking too much warm water: yet every section man is forced to give up $5 or $6 per year to the company that pretends to look after his health. In the city of Denver, Col., the stray dogs do not pay hospital fees, yet at the instigation of the Humane Society the city will supply fountains at which any dog may obtain a drink of cold mountain water at all times. How we envy the dogs!

Quick Time from England.—Nine days and 15 hours is the latest record time for goods from England to Chicago. The American liner St. Louis left Southampton July 30, with a big consignment of goods and on the afternoon of August 10 these goods were offered for sale across Field & Co.'s counters in Chicago. This time between England and Chicago beats all previous freight records. Usually 19 or 20 days elapse after the order reaches English exporters before a Chicago merchant expects his goods. The St. Louis made the trip to New York in 6 days 2 hours and 30 minutes. Then the International Navigation Co. took hold of the consignment, rushed its transfer to the Pennsylvania road, and it came through on regular mail time. Chicago importers express pleasure over the phenomenal time made.

British Mail Subsidies.—The New York correspondent of the London Times supplies in a recent issue some particulars respecting the inefficiency of the postal service from that country to New York. He states that the American liner St. Paul, leaving Southampton on Saturday, the 11th, arrived at New York on Friday evening, and delivered by the first post on Saturday morning the few specially addressed letters which the British post office allowed her to bring. The Cunard steamship Umbria, sailing from Liverpool the same day, arrived on Saturday evening. She brought the whole accumulated English mail from Wednesday to Saturday. It will be delivered in New York on Monday morning, nine days out from Liverpool, and two days later than if it had been sent by the St. Paul. The American public has therefore to thank the British post office—first, for so arranging its service that a whole week passed without any mails; secondly, for sending by the slow White Star steamship Britannic when two faster ships of other lines were available; thirdly, for sending by the Cunard steamship Umbria a mail which the St. Paul would have delivered two days earlier; and, fourthly, for boycotting three ships out of five during the week, and for preferring the private advantage of two steamship lines to the welfare of the public. The experience of last week is, no doubt, exceptionally bad, but it recurs monthly. In these days of swift ocean travel it is a strange anomaly to dispatch mails by such a ship as the Britannic, requiring practically ten days to perform her mail service between London and New York. Her mails of Wednesday, July 8, were received by the business community of New York at the same hour as those brought by the St. Paul, leaving sthree days later. The feeling of this community is simply that they are trifled with, and that very important business interests are systematically sacrificed.

Large Lake Boats.—The Sir Wm. Fairbairn, the longest vessel on the lakes, and lacking but 2½ ft. in beam of being the largest vessel on the lake, was launched by the Detroit Dry Dock Co., Saturday. Her engines are 24, 38 and 64 with 42 in. stroke, and the two boilers are 14½ x 11½ ft. This is a smaller power than in any of the Bessemer fleet, but it will be more than made up by the addition of Howden hot draft system. None of the others will have this, and this will give an excellent opportunity for comparison. The water bottom will hold 2,000 tons of water. Her shapes, if laid out in a straight line, would stretch away 17 miles and 4 rods, and her plates would stretch out 7 miles, 38 rods and 6 ft. There were driven into her hull 415,553 rivets and their combined length is 622,905 in., equal to 9 miles and 266 rods. The John Ericcson, another of the Bessemer ships, will leave the yard of the American Steel Barge Co., some time next week, but her tow barge will not be ready for a month. This steamer and barge will make up the largest tow on the lakes, and will carry upwards of 10,000 tons on 15 ft. draft.

Increased Use of Liquid Fuel on Locomotives.—The use of liquid fuel has been so extended on the Great Eastern Railway, of England, that a large storage plant has been erected at Stratford. Twenty-five locomotives are now fitted with oil burners under the Holden system, and twelve stationary boilers and three furnaces at the shops burn the same kind of fuel. The oil arrives at Stratford in bulk, old locomotive tenders being employed in transporting it at present. The storage tanks are thirteen in number, and are placed on low ground not very far from the main line. The oil flows to them by gravity. A peculiarity of the tanks is their rectangular shape. Nine of them hold 3,000 gallons each, and the remaining four 2,500 gallons each.

The Loss from Smoke.—It is generally supposed that the black smoke issuing from factory chimneys carries away with it a not inconsiderable proportion of the fuel burnt; but Scheurer-Kestner contended that this loss is considerably over-estimated, being confirmed by Professor Tatlock, who found the coal he experimented upon to contain 37.63 per cent of gas, tar, etc., 49.97 of carbon, 0.4 of sulphur, 2.72 of ash, and 9.28 per cent of water. If the quantities of heat given out in burning be estimated from these data, it will be found that the volatile constituents, such as gas, tar, etc., only give up 15 per cent of the carbon, but 85 per cent of the collective heat. Coals used for industrial firing, however, do not even contain 37 per cent of volatile matter, so that their share in the general heat production is still less than 15 per cent. It can therefore be asserted states the Deutche Chemiker Zeitung, that even if all the volatile matter be dissipated by combustion—which, of course is not the case—the loss of heat will amount to 15 per cent at the outside. The gases resulting from the combustion of the coal whose analysis is given above showed, on analysis of very thick smoke, 5 per cent by volume of carbonic acid, traces of carbureted hydrogen, 79.9 per cent of nitrogen, and 15.1 per cent of oxygen, while the soot contained 7.15 millgr. per cubic metre of carbonaceous, and 4.78 millgr. per cubic meter of mineral matters. Now one metric ton of coal yields on an average, 26.32 cubic metres (929 cubic feet) of gas, with a mean carbonic acid content of 5 per cent by volume, measured at the ordinary pressure and temperature: so that these contain 26.32 x 7.15—18.8 kilogs. (41 lb.) of carbonaceous and 26.32 x 4.78—12.6 kilogs. (27 lb.) of mineral substances, and, consequently only 31.4 kilogs. (69 lb.) to the ton. It follows from the above that the loss of heat by smoke, compared with the theoretical calorific capacity of the fuel, is about 0.74 per cent—that is excessively slight. As regards saving in coal, the smoke consuming apparatus are not so greatly superior to the ordinary firing arrangements; but they possess so many other advantages that their introduction is still devoutly to be wished.

Stock and Grain Speculation in Germany.—It is the purpose of the German government to exercise severe control over stock exchange transactions and the issue of stocks and bonds by new companies, with a view to lessening speculation and protecting the public from fraudulent or uncertain financial and commercial enterprises. A comprehensive law to this end has just been adopted by the Reichstag by an overwhelming majority. It is likely to cause a revolution in the present stock exchange methods. In the first place, it is intended to discourage stock speculating by forbidding certain Borsen-Termin-Handel (exchange time contracts) for grain, as well as stocks and bonds. The government will assume a certain control over all stock exchange business, with special reference to the listing on the stock exchange of new issues of stocks and bonds or paper of new companies. It will endeavor to maintain less fluctuating and, as the agrarians hope, higher prices for grain and mill products by forbidding all time delivery contracts being made on 'change for such grain and products. The rapid growth of stock speculation in Germany and the heavy loss experienced by the public are said to have caused this legislation to have been set afoot and adopted. It is more likely, however, to have emanated from the agrarians, who think, by such legislation, to bring about an increase in the price of grain and produce in Germany. No matter what the source of inspiration may have been, the effect, if carried out, will prove wholesome if it prevents stock gambling and makes it difficult to float unsound stocks upon the the market.

Society for the Promotion of Engineering Education.

A circular has been received from Prof. C. Frank Allen, secretary of the Society for the Promotion of Engineering Education announcing the program of the fourth annual meeting of that organization which is to be held at Buffalo, New York, Aug. 20, 21 and 22, 1896, in connection with the meeting of the American Association for the Advancement of Science.

The society, as guests of the Engineers' Society of Western New York, will hold its meetings in the Library building, the headquarters of the Engineers' Society, on Lafayette Square.

There will be five sessions for the reading of papers and the transaction of business. These sessions will be held Thursday morning at 9:30; Thursday evening at 7:30; Friday morning at 9:30; Friday evening at 7:30; and Saturday evening at 7:30.

There will be an excursion Saturday under the auspices of the Engineers' Society of Western New York, as follows: Leave Buffalo at 9 a. m., via Electric Railway to Niagara Falls, stopping and examining the power house of the Niagara Falls Power Co., the Pittsburgh Reduction Works, and possibly other plants in that vicinity (Niagara Falls Paper Co., Carborundum Works, etc.) The route will be continued, via Electric Railway, down the river to Lewiston, through the Gorge, returning by the same route to Niagara Falls, where lunch will be served at 1:30 p. m. The following plants will be visited here: Niagara Falls Hydraulic Co., (100,000 horse power) Schellkopf Mills, Cliff Paper Co., and perhaps others, returning to Buffalo via Electric Railway.

Thursday afternoon, Friday afternoon, and Sunday will be available for seeing some of the attractions of which there are very many in and about Buffalo of interest to engineers, or for rest, as suits individual preference. The program has been arranged with this end in view. No attempt will be made at this time to schedule the points of interest and the means of reaching them. It is sufficient to say that Buffalo is rich in features of interest to engineers, whether civil, mechanical, electrical, or mining. Further information in detail will be available at the time of the meeting.

The American Association for the Advancement of Science holds its annual meeting during the week following (beginning Aug. 24.) Members of the Society for the Promotion of Engineering Education are especially invited to be present to hear the address of Prof. F. O. Marvin before section D, on Monday, Aug. 24, at 2:30 p. m., in the Library building: "Subject: "The Artistic Element in Engineering."

TESTING STEEL FOR MARINE-ENGINE CONSTRUCTION.

At the French Government Engine Works at Indret the steel used is classified under three heads—namely, (1) semi-hard (32 to 35 tons tensile strength with 20 per cent elongation) in the forms of hammered blooms and hexagonal bars: (2) castings to pattern; and (3) soft (25 to 29 tons tensile with 23 per cent elongation), and extra soft (21.6 to 25.4 tons tensile with 25 per cent. elongation), also in blooms and bars. The tensile tests are made with the Thomasset testing machine, in which the stress is continuously indicated by a mercury column, while the changes in the test-piece are recorded graphically by a registering apparatus designed by Messers. Richard Brothers, the latter addition being especially useful in fixing the elastic limit—a factor which, for constructive purposes, is of greater value than the ultimate strength. Illustrations are given of some of the curves obtained by this apparatus.

The toughness, or resistance to fracture by impact is in the harder qualties tested by the falling-weight method, on what is known as the Ruelle machine, where the test-piece—200 millimetres long and 30 millimetres square,—laid upon knife-edges 160 millimetres apart and projecting 50 millimetres from the anvil, is subjected to the blow of a falling weight of 18 kilos, with a rounded end striking midway between the points of support. The minimum weight of the anvil is 350 kilos., the hight of fall and other conditions varying with the class of material. For blooms the whole number, and for bars one-half, of the test-pieces must not break before the fifteenth blow, when the fall is 2.75 metres; while for unforged castings with test-pieces of the same size the initial fall is 1 metre, which is increased progressively by increments of 5 centimetres to a maximum of 1.5 metre, the half limit of resistance being applied as in the case of bars.

Soft steel is tested for toughness by the forge test of doubling under the hammer when water-hardened. The author considers these tests, especially the last to be essentially unsatisfactory, as so much depends upon the degree of heat employed. If the metal is too cold the hardening effect of the water is nil: while if the proper heat (about 9000) is used the structure is so much changed that the test may be satisfied even by steel originally of bad quality. He therefore proposes to modify the falling-weight test, that it may serve both for breaking and bending uses. In this method the test-piece—20 millimetres square—is clamped in a holder with an overhanging length of 100 millimetres, which receives the blow of the tup on its outer end. The bar is nicked on all four sides in the plane of the outer face of the holder, and when so weakened it can be broken by a single blow of the weight falling from a hight varying with the quality of the metal, and which is called the height of rupture. If, however, the section is not weakened the by grooving, the overhanging part is merely bent by the blow, and the angle of deflection produced is taken as a measure of the rigidity of the metal. This angle may be from 140 to 160°.

The author considers that steel in the "natural" state is sensibly brittle, whatever may be the amount of carbon contained, and that a soft or extra soft metal giving 25 per cent elongation is not sensibly safer against breaking than the stronger but less ductile kinds of 30 tons to 38 tons tensile strength, and that the latter should be preferred for moving parts, subject to wear from friction, such as piston rods, guide blocks, slide-valve faces, etc., as many accidents to engines on service have arisen from the use of piston rods made of steel of too soft a quality. In all cases the metal must be subjected to the process of double-tempering, i. e., a first tempering from a bright cherry red, to effect the transformation of the grain, followed by a second from a dull red, which is more properly annealing, for bringing down the hardness to the required degree, and removing strains producing brittleness. The effect of this process in modifying the fragility and elastic limit in forged steels of the two classes is shown in the following results, obtained by tempering the test-pieces in water at about 170° F.:

	Soft.		Semi-hard.	
	Natural.	Tempered	Natural.	Tem.
Elastic limit, tons.	12.0	20.	16.0	26.7
Hight of rupture, metres	0.2	2.0	0.2	1.8
Angle of bend degrees....	143	153	151	158

In a second series of experiments the bloom was reduced under the hammer to two-thirds of the original section, with the result of rendering it more homeogeneous, which without altering the ultimate strength and elastic limit has a very marked influence on the elongation, and more particularly upon the contraction, which not only became larger but also more regular, being for semi-hard steel when

	Forged.	Natural.
Non-tempered—elongation	24 - 25 per cent, instead of	13-16 p.c.
Tempered elongation	17 - 18 per cent, instead of	7-11 p.c.
Non-tempered—contraction	70 - 80 per cent, instead of	14-24 p.c.
Tempered contraction	141 - 163 per cent, instead of	22-70 p.c.

The method of double-tempering is now applied at Indret to all forgings for engine work, and with the exception of the larger engine framings, to most of the castings. A further advantage in its use for these is that cracks are more readily seen when the metal is heated, so that there is greater certainty in detecting unsound castings. The tempering plant is capable of handling objects not exceeding 6 metres in length. Screw-shafts are received forged and tempered at the makers' works (Creusot and Saint Chamond) subject to the following conditions:—

The shafts of steel, either tempered and annealed or double tempered, must satisfy the following tests:—Two sets each of five test pieces to be taken from slabs cut out of a waste piece of the full size of the shaft and parallel to its length, those for tensile and elastic limits being 100 millimetres long by 13.8 millimetres square, and those for impact 20 millimetres square and not less than 180 millimetres long. These are to be cut to shape cold, and if any of them are unsound others may be cut from the same slabs; but should these be defective the article may be rejected. Three out of five pieces are to be tested for elastic limits, and incidentally for tensile strength and elongation; but these latter tests are not material. Should the elastic limit of any one be below 28 kilos. per millimetre, or that of the mean of the three below 30 kilos., the other two shall be tested, when after rejecting the lowest of the five, the average of the four must not be below 30 kilos. or any one below 28 kilos.

For the impact test the bars are to be scored on all four sides, at a distance of 100 millimetres from one end, by a cutter of the form of an equilateral triangle of 1 milimetre in the side, made very exactly to gage. When clamped in the holder by a length not less than 80 millimetres, the piece must not break under a single blow of a weight of 18 kilos. falling 3 metres. Should any one of the three pieces fail, the test is to be extended to the remaining two.

Any article not satisfying the tests specified above may, after retempering or annealing, be subjected to a second trial.

These conditions, which are perfectly satisfactory to the manufacturers, are especially valuable as giving a precise idea of the practical value of the material and have also led to a considerable reduction in the number of test pieces required in carrying on the current work of the establishment at Indret.—Institute C. E. Foreign Abstracts.

A SIMPLE DERAILING SWITCH.

To avoid many of the objections to the usual form of split switch when used as a derail at interlocking plants and for the protection of sidings, the Travis derailing switch has been designed and patented by Mr. O. J. Travis. The greatest trouble with the ordinary form of derail is that these points will fill with snow and cause the switch to remain slightly

Fig. 1.—SWITCH WITHDRAWN FROM RAIL.

open, which is at once dangerous and troublesome. Also, the placing of a split switch necessitates the cutting of the main stock rail which leads to the evils of the creeping of the points. A satisfactory derailing device which will not require the cutting of the

Fig. 2.—SET FOR DERAILING.

stock rail will fill a demand and be appreciated by signal engineers and trackmen.

The device as shown in the accompanying engravings is in use at East Grand Avenue, Springfield, Illinois, at the crossing of the Illinois Central and the Chicago, Peoria & St. Louis Railroads, where it is reported to be giving satisfaction. The open or all clear position is shown in Fig. 1, while the derailing position is indicated in Fig. 2. From these illustrations it will be seen that the device is very simple, consisting of but two parts, the steel bell crank, the long arm of which passes over the rail, and the support or base which secures the fulcrum of the crank. Fig. 2, shows the form of the enlarged end of the arm to best advantage and it will be seen that this part is shaped so as to bear with a vertical flange against the outside of the rail head. The forging carries another vertical flange upon its top face, so inclined to the direction of the rail as to guide the flange of a wheel over to the outside of the rail, while the chamfered front surface of the forging will lift the wheel over the rail. The short arm of the crank is connected to the derail pipe line and upon the opposite side of the track is the detector bar also connected with that pipe.

Beside the freedom from trouble on account of snow packing about the derail, this device seems to offer a great advantage over the old form, on account of the ease with which it may be worked, relieving the pipe line and connections from the heavy duty of bending a switch point into and out of position. This device would lighten the work sufficiently to materially reduce the wear of parts and at the same time render the operator's work easier. It is also well adapted to the derailing of freight cars on hill sidings to prevent them from drifting out upon the main track. In this application the ease of working should also be valuable, inasmuch as it is desirable that switch stands should work as freely and easily as possible. This switch could be applied so as to be operated by the switch stand, which controls the main line switch without unduly increasing the work put upon the stand. The National Switch & Signal Co., of Easton, Pa., is manufacturing and furnishing these switches and will give further information concerning them upon application.

The Question of Honesty.

Let us strip the matter of all technical and perplexing details. Let us narrow it down to the closest and clearest issue. Let us dismiss all other questions, and ask simply, "Will it be an honest thing for Mr. Bryan to pay the notes and bonds of the government in silver?" That is the issue in a nutshell. Mr. Bryan is committed to doing this thing. It is immaterial that the principal of the bonds is not now payable; the money that is used to pay the interest will fix the value of the principal. Whoever votes for Mr. Bryan, votes beyond question for this policy, and he cannot claim to be an honest man unless he holds this to be an honest policy. We do not see how any one can conscientiously hold such a view, and we shall state what it implies in a few simple words.

The silver dollars under free coinage will not be worth so much as the gold dollars. They will not buy so much bread, fuel, or clothing, or pay so much rent. There is no disagreement about this. Those who want silver coinage say distinctly that they want it because it will make prices higher—that is, because silver dollars when coined freely will not purchase so much as the gold dollars. That is the reason why they want free silver, and that is the reason why their opponents do not want it. If prices were not going to rise under free coinage, no one would care whether we had it or not. So much, then, is beyond dispute; with free coinage, prices would rise—that is, the dollars that we should have would not buy so much as those we have now.

Let us now, for sake of simplicity, suppose that the bonds of the government are all held by the savings banks. No doubt many of them are held by other banks, trust companies, fire and life insurance companies, and by individuals. But let us keep to the savings banks alone. For nearly twenty years all our dollars have been as good as gold dollars. Every one who has a silver or a paper dollar could get the value of a gold dollar at any time, and debts due to people in other countries could practically be settled with our dollars at a par with gold. During this time the savings now held by the banks must all have been paid into them; if there are any accounts of longer standing than this, they have been drawn down and replenished within that period. Hence it is true that all the dollars of deposits now in these banks have been paid in gold dollars or in dollars equal in buying power to gold dollars. And all the government bonds bought with these deposits have therefore been bought and paid for with gold dollars, or with dollars equal to gold dollars. Moreover, the people who, through these banks, converted their savings into government bonds, supposed that

these bonds were to be paid in gold. Such bonds always have been paid in gold, or in dollars convertable into gold, whenever they have been paid, and the interest has always been paid in gold or its equivalent. And this interest was so paid when the government had practically to buy the gold to do it, and when the war taxes were higher than now, and when there were not so many people in the country as now, and when the people were not so well off as they are now. There was some talk at one time of paying the interest in paper, but it was shown that this would be a breach of good faith and the people voted it down.

Now, what Mr. Bryan proposes to do is to pay off the people who lent gold dollars to the government through the savings banks in silver dollars: to give them back dollars that will not buy as much as the dollars they lent. Perhaps prices have fallen since 1873. But these savings setting off the withdrawals against new deposits, have all been made within a few years, and gold has not risen perceptibly in value in that time. And during recent years the government has paid off its old bonds and issued new ones bearing very much lower interest, so that the savings bank depositors have lent their money to the government with less gain to themselves than before, even if gold has risen in value. On the other hand, the silver dollars will be worth very much less than the gold dollars. The silver in one of them if melted would sell for only 53 cents in gold just now, and would probably be worth not much more if silver dollars were coined freely. Suppose it would sell for 60 cents; then every one who had bought a government bond, paying for it 100 gold dollars, would be paid off in 100 silver dollars, which would be worth 60 gold dollars. The savings, therefore, would buy perhaps three loaves of bread when they would have bought five if the government had paid back what it borrowed, three tons of coal instead of five, three months' rent instead of five, etc., etc.

The people who put their dollars in the savings banks, and in that way in the bonds of the government, are for the most part plain people, workingmen, domestic servants, teachers, and old people, who have never thought about bimetallism, or the act of 1873, or the appreciation of gold. Least of all have they thought that their government would commit a breach of faith. The proverb "Good as a government bond" expresses their simple confidence, and probably most of them have no idea now what Mr. Bryan proposes to do or how it will effect them. But the believers in free coinage know what he is going to do, and if they say that what he is going to do is honest, they must offer some explanation of its effects as described above. They must convince the people who have put money in the savings banks that it is right and just that they should get back what is worth little more than half what they put in, in full satisfaction of their claims. This matter has got to be explained, and not slurred over, if Mr. Bryan expects to make converts in this part of the country, and if it is ignored, it will be treated as a confession of dishonesty.—[The Nation.

BRIDGE OVER MINNESOTA RIVER—MINNEAPOLIS & ST. LOUIS RAILROAD.

The accompanying illustrations show a general view and the principal details of construction of the new three span Pratt combination bridge which has just been built by the Gillette-Herzog Manufacturing Company of Minneapolis, Minn., for the Minneapolis & St. Louis Railroad. This bridge is located at New Ulm, Minn., and crosses the Minnesota river with three 112 ft. spans supported upon pile foundations and wooden piers. The approaches are of timber bents upon piles and were included in the contract. It is of special interest to note that this work was taken in competition against bids on Howe truss spans.

As shown in the drawing, the bridge is pin connected. The floor system is hung from the lower panel points upon 3½ in. pins by means of plate hangers 10 in. by 2 ft. 9 in. by ½ in., which are riveted to the ends of the plate girder floor beams which are 36¼ in. deep and 16 ft. 10¾ in. long with 3½x3½x$\frac{7}{16}$ in. flange angles and 3x3x$\frac{5}{8}$ in. stiffening angles. These beams are placed at 16 ft. centers. The spans are, as stated, 112 ft. in length and are composed of seven panels of 16 ft. each. The hight of the truss is 24 ft. and the clear roadway 15 ft.

The stringers are eight in number, three 8x16 in. sections being under each rail and one 6x16 in. section, the center of which is 2 ft. 10½ in. from the center of rail upon each side. The ties are 6x8 in. by 12 ft., spaced at 14 in. centers and notched over the stringers. The guard timbers are 6x8 in. and are notched to a depth of 2 in over each tie. They are bolted by ¾ in. bolts to every third tie. The end posts are composed of 7x15 and 8x15 in. timbers 28 ft. long as shown in the drawing. The top chord is composed of 7 and 8x14 in. pieces 15, 18, 30 and 32 ft. long and the top laterals are 6x8 in. by 20 and 22 ft. The portal struts are 10x14 in. by 16 ft. and the knee braces are 6x8 in. by 16 ft., the collision struts being 6x8 in. by 12 ft. The intermediate posts are 10x10 in. by 22 ft. 6 in.

The timber throughout is Douglas fir, with the exception of the ties and guard rails, which are of white pine. All rods, including the counters, laterals and hangers, are of wrought iron. The floor beams are medium steel, as are likewise the eye bars, the latter having been subjected to a special

BRIDGE AT NEW ULM—MINNEAPOLIS & ST. LOUIS RAILWAY—FIG. 1.—GENERAL VIEW.

inspection. Standard specifications were used for all of the metal work. The floor beam hangers are riveted plates and the bottom lateral connections are split eyes or clevises.

The static load was taken at 1,200 lbs. per lineal foot, and the moving load provided for was a 100 ton locomotive. The tensile stresses allowed in the iron counters was 12,000 lbs. per square inch net, while 20,000 lbs. per square inch was allowed in the laterals. In the steel work the limit was 12,000 lbs. For

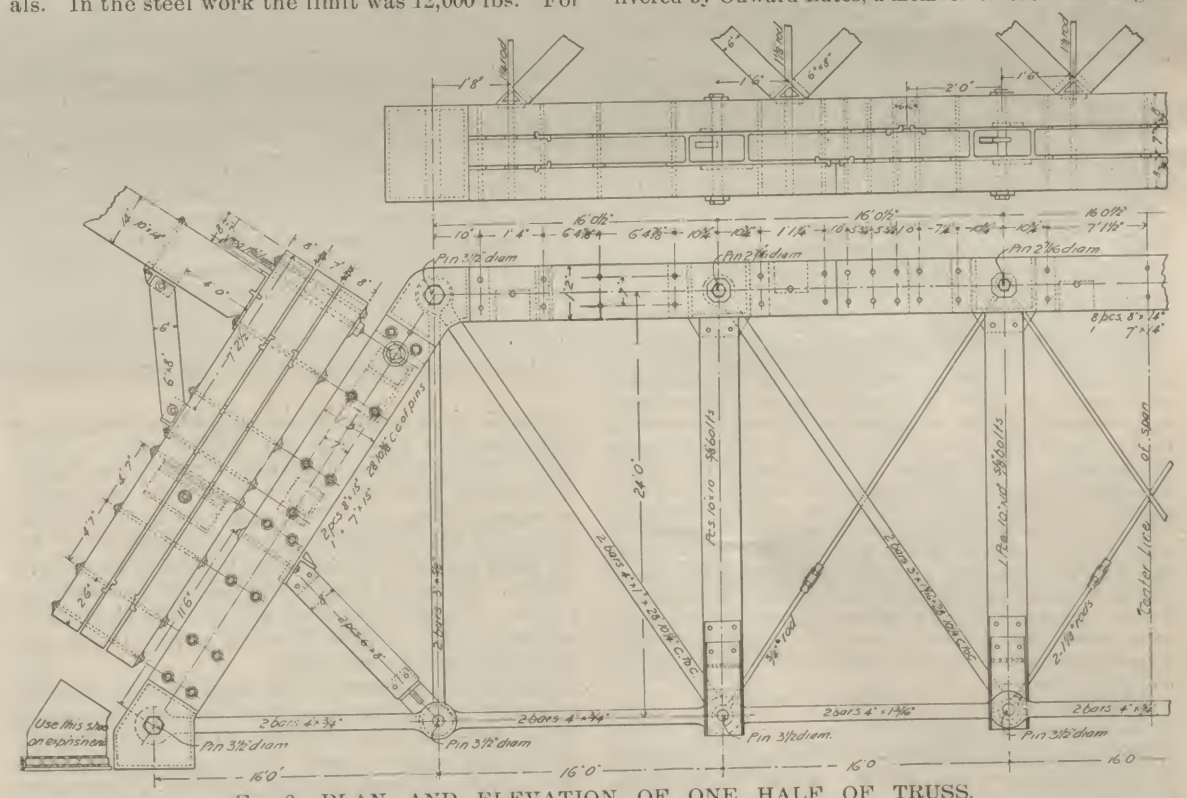


FIG. 2.—PLAN AND ELEVATION OF ONE HALF OF TRUSS.

compressive stresses the formula $2500-0.6\left(\frac{l}{d}\right)^2$ was used with a factor of safety of 5. Shearing stresses were limited to 7,500 lbs.; pin and rivet bearing stresses to 15,000 lbs., and the extreme fiber stress in bending was 22,500 lbs.

Other interesting details of construction will be found upon examination of the drawing, which indicates the form of the castings and plates used for making the connections between the different members. We are indebted to Mr. Frank J. Llewellyn; chief engineer of the Gillette-Herzog Manufacturing Co., for the drawings and information presented.

A RAILWAY ENGINEER.

Under the above caption, Indian Engineering comments editorially upon the address of Mr. Onward Bates, engineer and superintendent of bridges and buildings of the Chicago, Milwaukee & St. Paul Railway, before the Engineers' Club of Purdue University in the paragraphs which are reprinted below. It is evident from these criticisms that our methods are little understood in India, and our definition of a "practical man" does not seem to be the same as theirs. It is also of interest to see the reference to departmentalism from one who knows of its evils so well as do engineers in India. The reply by Mr. Bates, which is appended, is valuable as coming from an engineer whose experience is unusually wide, including work in foreign countries and under the conditions which obtain in the British colonial service.

It is always profitable to look abroad and see how others manage their work and not to assume that the organization to which we are accustomed is the only possible or even the best. The RAILWAY REVIEW of the 8th of February gives an insight into the organization of American roads which will certainly strike most of our readers as a novelty. The article in question is a lecture delivered by Onward Bates, a member of both the English and American Institutions, to the Engineers' Club of Purdue University, and the title is "A Railway Bridge and Building Department."

After some sound and general advice to the students, the lecturer proceeds to say "that he is of opinion that engineers have not paid the attention to this class of work that it is entitled to from its great extent and variety. A railway engineer is usually considered to be one who is or has been engaged on surveys and first construction of railways"

He then defines the usual organization of a railway, with the transportation, or as we call it, the traffic department: the maintenance department, usually subdivided into the department of "rolling stock and machinery" and "maintenance of way," which on some large rail-

way systems is again divided into the "track department" and the "bridge and building department," and makes the following remarks, which cannot be too often repeated: —"All these departments and sub-departments, being engaged in the business of keeping the machine in order have a common interest, and their duties and responsibilities are more or less common. In some cases it is difficult to define these duties within exact limits, and there is opportunity for friction between employes of different departments, but such friction does not need to exist when the heads of departments place the interests of the company before their own selfish plans or fancied rights."

"Departmentalism" is the curse of large companies as it is of government service, and who cannot recall instances of the general concern suffering a loss, in order that some department shall show a paltry saving? It is in this point that departmental heads who have risen from the ranks, generally fail; they are excellent masters of their own detail, but have no breadth of view.

But now comes the extraordinary part of the lecture. "The whole maintenance department of a railway. whether it is long or short, should be under the direction and control of a chief engineer, with such divisions of bridges, buildings, track, rolling stock and machinery among his subordinates as would be determined by the length and conditions of the road. This requires that the chief engineer shall be an executive officer, and that he shall have business judgement and the ability to handle men, *and it will be advanced in argument that engineers lack these qualifications. To some extent this is the case, and if the maintenance of all the railway lines in this country was suddenly transferred to the care of engineers, it would be difficult to find a sufficient number of qualified engineers to assume the duties.*" The lecturer then proceeded to explain that the reason for this defect was merely a lack of education, since engineers were as susceptible of business education as men in some other occupations! That it should be gravely argued whether an engineer can or cannot be a good man of business seems to our ideas an utter absurdity. It appears then that in America engineers have principally been employed in building railways, and that the majority think the maintenance should be under the superintendent of transportation and not under an engineer. If this is really the practice it explains the frequency of bridge disasters in America. And further on it is stated that the actual work of construction and maintenance should be carried on by that department of which the chief engineer is the head, and in discussing his subordinates says — "the bridge and building department may properly be united with the track department. * * * Its immediate practical head is on most railways a superintendent of bridges and buildings. *This superintendent is usually a practical man and not an engineer.* * * *" With a departmental head who is not an engineer and a bridge superintendent who is a "practical man" we rather wonder that insurance companies can be found to accept the risk of railway journeys at all. Is it possible that on any number of American railways, the maintenance of bridges and tracks is really in the hands of men of no better qualification than our old friend the plate layer, who works "by eye"? We were aware that in buying road bridges, the advice of an engineer is not considered necessary, and that in consequence failures of even new bridges are quite common, but we did not know that this unprofitable arrangement extended on railways to that extent which the lecturer has revealed. Quite recently there was a failure of a bridge under an electric tram, because in erection a main brace and counter had been misplaced in all four panels where it was possible, being put in "by eye" by a practical bridge builder.

Among other points the lecturer says that the rolling stock department should be subordinate to the chief engineer, though its actual head should be an expert in that branch of engineering. This is about the only point in which we differ from Mr. Bates. For quite a small line the best arrangement is to have an engineer at the head and to preside over all departments, but a comparatively small extent of traffic or mileage renders it advisable to have responsible heads of departments, each an expert in his own work and directly responsible to the administrative authority. In short, our transatlantic cousins might well follow universally the ordinary organization of an English or Indian railway, which has as a minimum an engineer to do everything, next a way and works and a rolling stock department, and with further development the first is subdivided into new works and maintenance pure and simple, and the latter into separate departments for the locomotive and for the carriage and wagon work, with the addition on many lines of a signal department whose shop work is done in connection with the locomotive department.

[The italics are not in the original paper.]—Ed.

To the Editor of the Railway Review:

I am duly complimented by the editorial comments of "Indian Engineering" on my lecture to the Engineers' Club of Purdue University, as published in your columns, and I am pleased to accept your invitation to reply to them. The Indian writer is much surprised and shocked to learn that on some of our railways the maintenance of bridges and tracks is in the hands of men who are not engineers, and proceeds to state that "the practice explains the frequency of bridge disasters in America." His criticism would perhaps be modified by a more intimate acquaintance with the conditions of American railway practice than could be obtained from the printed copy of my lecture. There are some conditions bearing on the maintenance of permanent way, and especially of railway bridges, in America which do not exist in India and other countries where the maintenance departments of railways are organized upon English methods. I will trespass on your space for only a brief mention of some of these conditions.

In the first place the "practical man" is educated by experience to meet the problems of maintenance, and becomes skilled in that particular branch of it, which engages his services. Take as an illustration the bridge carpenters who maintain the ordinary wooden bridges on a railway, and it is marvelous with what accuracy they will cut off the piles for a pile bridge "by eye." Even when the bridge is on a curve they will sight a grade and put in super-elevation with an accuracy that seems hardly possible to a theoretical man. Transportation officials under whom practical men serve also gather by experience some degree of expert knowledge, although the degree is inferior to that which is acquired by special education. In the next place, it is the common practice of those railway companies who do not employ engineers in their maintenance departments to contract for bridges and other works with firms or companies who do employ skilled engineers, and the practical maintenance employe has nothing to say about the plans and specifications for these structures. This custom has offered inducements to engineers to associate themselves with contracting firms, and many of the most eminent engineers of this country have so obtained their experience. This system of leaving the theoretical work to contractors is faulty, because the services of the engineer are not permanently employed and competition between contractors does not tend toward the best class of work.

I have mentioned enough to show that even on those railways which neglect to secure proper engineering supervision the maintenance departments are not left helpless, and the practical man who works "by eye" is not by any means a failure. A resourcefulness and a capacity to meet all sorts of problems is developed in the practical men who keep pace with the extraordinary extension of railways in this great country that can never be met by theory alone, and can only be exceeded by adding theory to experience. We have now outgrown the formative stage and it is becoming more and more necessary that men shall be specially educated for the duties which they have to perform, and it is inevitable that the maintenance of railways shall in the future come under the control of engineers of maintenance whether they be known by that name or not. Railways that will not recognize this fact are back numbers, and invite reproaches which cause our friends abroad to have a mistaken opinion with regard to American railways in general.

I think that Indian Engineering is mistaken with reference to the frequency of bridge disasters in America and that they are not more common here than in other countries. With regard to the division of maintenance between a civil engineer for permanent way and a mechanical engineer for rolling stock, that is correct, but they should both report to the chief engineer, who should be either a civil or a mechanical engineer selected with special reference to the preponderancy of the duties, as well as to his personal qualifications, and he should be the head of the whole maintenance department.

Onward Bates.

An Object Lesson for Young Mechanics.

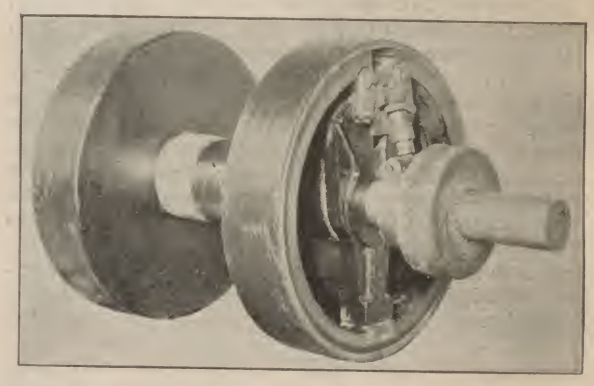
Mr. B. hired a new man last month, a young fellow of the modern type and one who evidently didn't learn his trade in a piece-work shop; he can handle any piece of work we have and give the boys points on most of them, too. He is an unobtrusive fellow, minds his own business better than most of us, but he has a pair of eyes that seem to take in things at a glance. He never bothers the index plate when he's cutting threads—just sizes up the way the lathe is geared and puts on the right gears, while most of us are fingering over the index.

Mr. B. put in a new grinder since the advent of the new man, and having seen that he was pretty quick with figures, he asked him about the right sized pulleys to get proper speed. New man told him in a few seconds—figured it out in his head. That set all the boys talking, and the questions asked him within the next few days were amusing as well as interesting. We had a little chat the other noon and I asked him what college he graduated from. "College," said he; "never saw one, not inside, anyhow. See here, Mr. Podunk, I'll tell you just how I came to be a trifle quick at figures. I was serving my time in the Blankville shops, and used to ask all manner of questions of the foreman and every one else. Figuring lathe gearing was always a mysterious operation to me, and the finding of pulley speeds and similar problems filled me with awe. We had a young draftsman who was good at figures, and after I had made life miserable for him for a month or so he asked me why in helenblazes I didn't learn to figure myself said he would gladly help me, but that he was everlastingly tired of being bored with such simple questions. I took the bait and started, and in spite of myself he showed me more about shop calculations than I ever dreamed of knowing, and gave me a start. His great hobby was, 'Know why you do it, and then you won't need the rule,' and its a right good point, too.

"It wasn't long before I did the figuring for the shop most of the men were too lazy or thought they couldn't learn, and it kept me in practice. Some thought it was wasted energy, and wouldn't do any good, and I almost came to believe it myself, but the foreman had been watching me, and when he found I could go ahead on a work, calculate my own change gears, the allowance for depth of threads in making taps, speed of milling cutters for best results, and in fact anything I had to do, he gave me the best work and made me his assistant as soon as I was out of my time. Well, to make a long story short, I have always had better work than the average, better pay and am often called in consultation on machine shop, and, while that dosen't pay in dollars and cents, as you probably know, it adds to my value in the shop. I suppose you'll wonder why I'm working at the lathe like the rest. Confidentially, I am getting familar with the work, and next month I expect to become assistant superintendent to Mr. B., but keep it dark, Podunk. If a boy asked me the most valuable thing for him to learn in addition to his trade, I should say, 'Learn to make all such calculations as are likely to come up in shop practice. Never mind the higher mathematics unless you expect to use them, but learn all you can about practical shop problems, and there are plenty of them.'" I guess he's right, for I'd give all my old overalls if I could figure out all of the things that come up in my own experience. —[Ichabod Podunk in Machinery.

FRICTION CLUTCH FOR TRAVELING CRANES.

The accompanying illustration shows the general appearance of a friction clutch used by the Phœnix Iron Works Co., of Cleveland, Ohio, for traveling cranes and other work for which friction clutches can be employed to advantage. The shell of the clutch is of cast iron, and the central arm which



FRICTION CLUTCH FOR TRAVELING CRANE.

carries the operating mechanism is of cast steel. The arm carries a band of vulcanized fibre which in throwing the clutch into gear is forced into contact with the cast iron shell. This operation is performed through the customary collar and adjustments are made by a right and left hand nut. The principal points of merit in the design are its simplicity and small number of parts.

THE BRAKING POWER OF PASSENGER TRAINS.

Though air brakes have for years received a large amount of attention at the hands of the manufacturers and railway men there seems to be a failure to properly appreciate the necessity of applying brake shoes to all the wheels of passenger trains which includes the truck wheels of the locomotive. There are two reasons why all wheels should be braked, first in order to obtain the proper ratio of brake pressure to the weight of the train when it is composed of heavy cars, and second to take care of the momentum of the wheels, due to rotation. The braking power which is applied to the reduction of the momentum of the wheels is used to excellent advantage, because it assists in effecting the stopping of the train and without making use of the adhesion of the wheels upon the rails. Considering the amount of power to be gained in this way and without danger of sliding the wheels, the absence of shoes upon truck wheels of locomotives and also upon wheels of cars does not seem to be satisfactorily explained. A correspondent of the Railway Master Mechanic in treating of

this subject in a recent issue of that journal writes as follows:

At a meeting held some time ago of one of the railway clubs a superintendent of motive power, whose remarks are always worthy careful consideration, made the following observation while discussing the design of passenger cars and the general make up of passenger trains: "Taking the train as a whole, I believe that we could not get up a better machine for killing people, in case of collision, than the present passenger train."

What had suggested such a remark was not explained, but accepting it as true and reasoning back, one thread of thought directs attention to the air brake equipment of each car and the locomotive separately and the order of distribution of the braking power in an average passenger train.

Bearing in mind the fact that there are many cars equipped with six-wheel trucks and only four wheels of each truck provided with brakes, which cars are running in trains with cars having all wheels provided with brakes an average train may be assumed as follows: Two express cars with six-wheel trucks, four wheels of each provided with brakes; weight 65,000 lbs. One baggage car four wheel trucks, weight 60,000 lbs. Two day cars, four wheel trucks, weight 65,000 lbs. One day car 80,000 lbs. and three sleeping or other heavy cars 85,000 lbs., each of which has six wheel trucks, but only four wheels of each provided with brakes. The weight of the locomotive may be distributed as follows; 70,000 lbs. on driving wheels and these wheels provided with brakes, 30,000 lbs. on truck wheels and these without brakes, 37,000 lbs. on two four wheel trucks and all wheels equipped with brakes.

Each weight assumed above is the weight empty. Assuming that the braking pressure on each wheel equipped with brakes is 90 per cent of the weight on the track under the wheel, then the total braking pressure of the train is about 73 per cent of the total empty weight. This is the best result that will obtain under the conditions named and, with the distribution of weight as assumed, is better than could be obtained in practice.

The other extreme condition will develop from assuming the maximum loading for each car and for the locomotive in working order, and it is found that the total braking pressure is about 60 per cent of the total weight of the train. Were every wheel provided with a brake and the braking pressure be 90 per cent of the pressure under each wheel of the empty car, then the total braking pressure would be about 82 per cent of the total weight of the loaded train.

The fact that in many instances the braking pressure is only about 60 per cent of the weight of the train, whereas it might be about 80 per cent, indicates one way in which the number of accidents might be lessened.

The braking pressure does not bear the same relation to the weight, either loaded or empty, in all parts of the train, but in an average train will be arranged frequently as follow: At the head end of the train is the locomotive, the braking pressure of which, taken as a single unit may be as low as 48 to 50 per cent of the weight in working order; this low percentage obtains when the tender is fully loaded and the boiler well filled. Back of the locomotive will be two or three cars with six wheel trucks, only two-thirds of the wheels with brakes on them; the braking pressure on these cars may bear about the same relation to the loaded weight as in the case of the locomotive, 48 to 50 per cent. There may be two or three day cars in the middle of the train which have four wheel trucks; the braking pressure will be 80 per cent of the loaded weight. On the rear end may be three sleeping or other heavy cars, with six wheel trucks and on which the braking pressure is 55 per cent of the loaded weight. Stated in tons the arrangement is as follows; 120 tons in the middle braked to 80 per cent, 200 tons on one end braked to 48 or 50 per cent, and 150 tons on the other end braked to 55 per cent.

Considering the generally lighter construction of the day cars and their arrangement in the middle of the train, perhaps it should not be surprising if they telescope or "double up" in a collision.

MOGUL FREIGHT LOCOMOTIVES—MAINE CENTRAL R.R.

A photograph and extracts from the specifications of one of a lot of five locomotives which have just been built by the Schenectady Locomotive Works for the Maine Central Railroad, have been received from Mr. A. J. Pitkin, superintendent of those works. These locomotives were built in conformity with specifications and designs prepared by Mr. Amos Pilsbury, superintendent of motive power of the Maine Central. Mr. Pitkin writes that the locomotives are giving excellent satisfaction, and that they are economical in the use of fuel. The boiler is of the extended wagon top type. The success is due to the large steam space and grate area and heating surface. The engines have low cabs and full decks, which are specially convenient for the runners and firemen.

The arrangement of the throttle, reverse lever, air valves and other attachments are the same as on the ordinary eight-wheel locomotive. The following items are taken from the specifications:

General Dimensions.

Gage	4 ft. 8½ in
Fuel	Bituminous coal
Weight in working order	136,600 lbs
Weight on drivers	117,600 lbs
Wheel base, driving	14 ft. 6 in
" " rigid	14 ft. 6 in
" " total	22 ft. 3 in

Cylinders.

Diameter of cylinders	20 in
Stroke of piston	26 in
Horizontal thickness of piston	5½ in
Diameter of piston rod,	3¼ in
Kind of piston packing	Dunbar
Kind of piston rod packing	U. S. Metallic
Size of steam ports	18x1¼ in
Size of exhaust ports	18x3 in
Size of bridges ports	1¼ in

Valves.

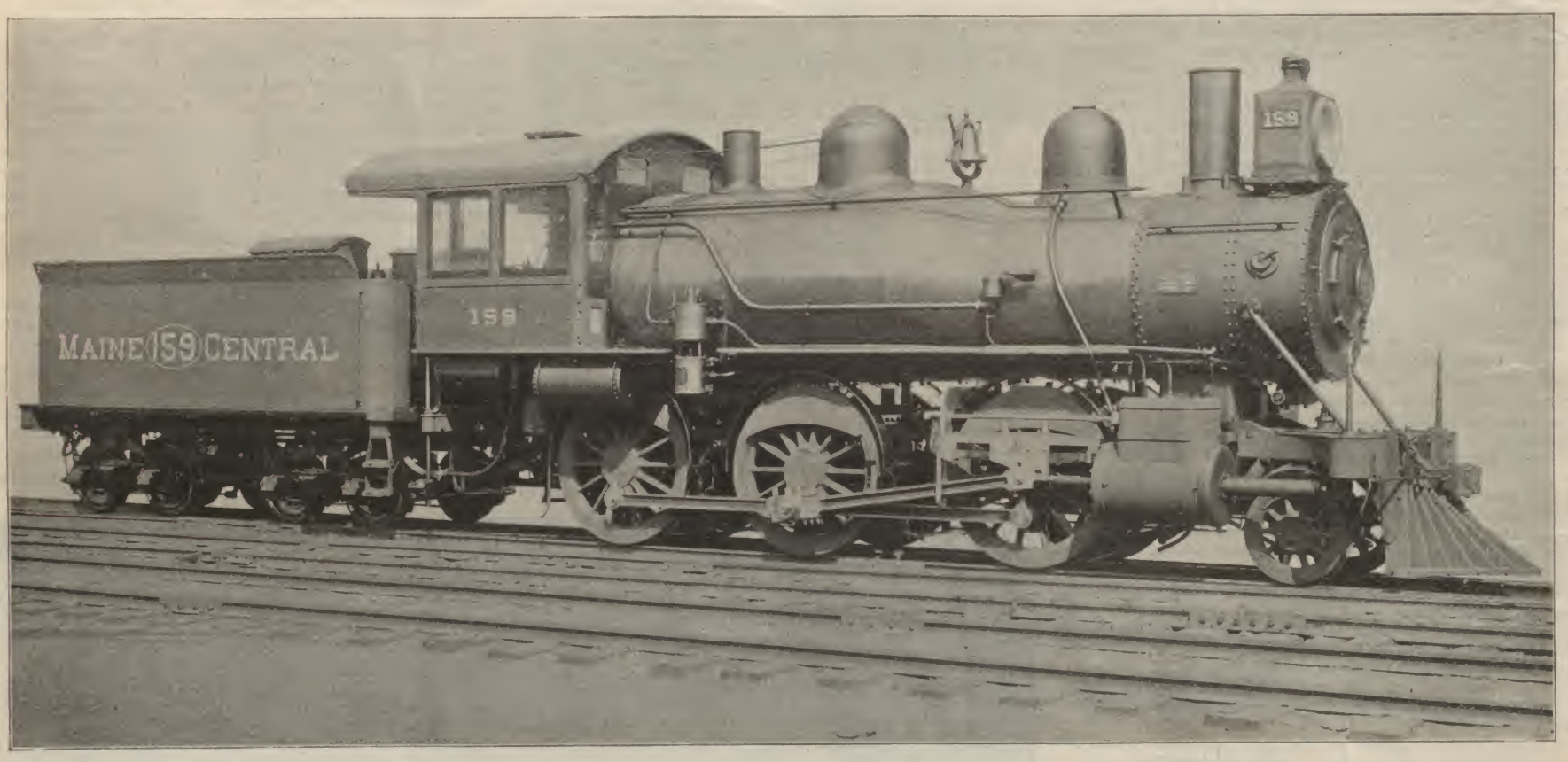
Kind of slide valves	Richardson balanced
Greatest travel of slide valves	5½ in
Outside lap of slide valves	¾ in
Inside lap of slide valves	1-32 in
Lead of valves in full gear	1-16 in
Kind of valve stem packing	U. S. Metallic

Wheels, Etc.

Diameter of driving wheels outside of tire	63 in
Material of driving wheel centers	Cast iron
Tire held by	Shrinkage
Driving box material	Steeled cast iron
Diam. and length of driving journals	8½ in. dia.x11 in
Diam. and length main crank pin journals	6 in dia.x6 in
Diam. and length side rod crank pin journals	Main 6½ in dia. x5¼ in F.&B. 4½ in dia. x3¾ in
Engine truck, kind	2-wheel swing bolster
Engine truck journals	6 in. dia. x10 in
Diam. engine truck wheels	33 in
Kind engine truck wheels	Krupp No. 3, tire 3⅛x5½ in. held by retaining rings

Boiler.

Style	Extended wagon top
Outside diam. of first ring	62⅛ in
Working pressure	190 lbs
Material of barrel and outside of fire-box	Carbon steel
Thickness of plates in barrel and outside of fire-box	½, 9-16, ⅝, 11-16 and 7-16 in
Horizontal seams	Butt joint, sextuple riveted, with welt strip inside and outside.
Circumferential seams	Double riveted
Fire-box, length	96 3-16 in
Fire-box, width	40⅜ in
Fire-box, depth,	Front 76 in. back 64 in
Fire-box, plates, thickness, sides,	5-16 in. back, 5-16 in crown, ⅜ in. tube sheet, ½ in.
Fire-box, water space	front 4 in. sides, 3½ in back, 4 in
Fire-box, crown staying	Radial stays 1 in. diam
Fire-box, stay bolts,	Taylor iron ⅞ in. and 1 in. diam
Tubes, material,	Charcoal iron No. 12 W. G.
Tubes, number of,	320
Tubes, diam.	2 in
Tubes, length over tube sheets	12 ft. 0 in
Fire-brick, supported on	Water tubes
Heating surface, tubes	1996.64 sq. ft.
Heating surface, water tubes,	20.51 sq. ft
Heating surface, fire-box	155.03 sq. ft
Heating surface, total	2172.18 sq. ft



MOGUL FREIGHT LOCOMOTIVE—MAINE CENTRAL RAILROAD—BY SCHENECTADY LOCOMOTIVE WORKS.

Grate surface,	26.96 sq. ft
Grate, style,	Rocking, with dump plates
Ash pan,	Sectional, hopper, with dump plates
Exhaust pipes,	Single
Exhaust nozzles	4⅞ in. 5¼ in. 5½ in. diam
Smoke stack, inside diam.,	16 in. at top, 14½ near bottom
Smoke stack, top above rail,	14 ft. 4¼ in
Boiler supplied by	Two Hancock inspirators type D. No. 9

Tender.

Weight, empty,	37,800 lbs
Wheels, number of,	8
Wheels diam.	33 in
Journals, diameter and length	4½ in. dia. x 8 in
Wheel base	14 ft. 6 in
Tender frame	6½ x 4 x ¾ in. angle iron
Tender trucks	4 wheel channel iron, Maine Cent. style
Water capacity	4,000 U. S. gal
Coal capacity	8 (2,000 lb.) tons
Total wheel base of engine and tender	47 ft. 7½ in
Total length of engine and tender	56 ft. 5⅜ in

The engine is fitted with the Westinghouse-American brake on all drivers also on the tender and for the train. It has the Westinghouse 9½ in. air pump; two 3 in. Ashton safety valves, one muffled and one open pop; asbestos cement boiler lagging; the Trojan coupler on pilot and rear of tender; the National hollow brake beams, with Lappin flanged shoes, and a No. 3 Crosby 6 in. chime whistle.

In view of the apparently inevitable misuse of tickets issued at reduced rates for the benefit of conventions of various sorts, it is a serious question whether the added revenue from increased travel is not more than offset by loss on regular business.

COMPRESSED AIR AT HIGH VS. LOW PRESSURES.

Last week a caution was given in these pages in regard to extravagant claims for the efficiency of compressed air and Mr. R. A. Parke, writing in "Compressed Air" confirms the position there taken. He also presents interesting statements with regard to the stages of compression and the comparative efficiencies of high and moderate compression which should be considered by those who are preparing to invest in compressed air traction apparatus. It is evident that haste should be made slowly in the application of this power on a large scale especially because of the disagreement among the doctors having charge of the case. Mr. Parke's arguments are specially directed toward comparisons between compressed air and electric power for the propulsion of street cars. They are, however, equally applicable to other uses of compressed air and are worthy of study. They are as follows:

The indications being that compressed air will be experimentally used for practical street railway operation at an early day, it should be earnestly hoped by all friends of compressed air and especially those who are interested in its introduction as a motive agent, that it will be so experimentally introduced as to give a reasonably fair impresssion. The use of compressed air for street car propulsion has hitherto been regarded with distrust and prejudice for several reasons. It may be reasonably hoped that a fair trial of compressed air for this purpose, under circumstances that will do it justice, will to a large extent, remove this prejudice and draw attention to the advantages of such a motive power. A number of important requisites to the fullest success of a compressed air system for street railway operation might be profitably considered. These features vary somewhat in importance in different systems which have been proposed. There are, however, two considerations which apply with equal force to all compressed air systems, and it appears desirable to draw attention to their importance at this time. The two features referred to are first, the pressure at which the compressed air is stored upon the cars, and second, the suitability of compressing apparatus for charging the cars. These two matters may properly be considered simultaneously.

The only apparent practical method of using compressed air for street car propulsion is that known as the storage system. In every case where air is stored in reservoirs upon the cars for this purpose, the air is admitted to the motor cylinders at a moderate pressure and is stored in the reservoirs at a considerable higher pressure, in order to enable the car to be run some distance without renewing the supply of air. There are two ways of increasing the mileage of car with one stored charge of compressed air—one is to enlarge the reservoir volume for storage and the other is to increase the pressure of stored air. For practical reasons the size and volume of storage reservoirs is limited and the temptation to store the compressed air at high pressures has consequently been great, in order to cover long distances with one supply of air. If the absolute pressure of the stored air be doubled, the available power, at the reduced pressure for the motor, is doubled; but in thus doubling the stored power, the cost of the compressed air supply has been very much more than doubled. After compressed air is stored in the reservoir, the temperature of that air becomes practically the same as that of the external atmosphere. Each cubic foot of air so stored, at an absolute pressure of p pounds per square inch, has required, in the process of compression and delivery into the reservoir, the expenditure of work, which, in a properly designed compressor is represented by

$$W=144\ p\frac{sn}{n-1}\left\{1-\left(\frac{p}{14.7}\right)^{\frac{n-1}{sn}}\right\}\text{foot lbs.}$$

In this formula, s represents the number of stages during compression, with complete cooling of the air to atmospheric temperature between each two consecutive stages; and n is a number not exceeding 1.408, and is usually a trifle less.

If the air be subjected to no cooling influence whatever during compression in the air cylinder, the value of n is 1.408. For practical reasons, it is always customary, in compression plants of any considerable size, to water jacket the air cylinders, which exerts a cooling influence, in greater or less degree, upon the air during the period of compression. Where the compressing cylinders are very small, it is not improbable that the cooling effect, due to the water jacket, is a very material one; but it has been fully demonstrated that where large compressing cylinders are used, as would be the case in a compressing plant of suitable proportions to supply a street railway system with compressed air, the cooling influence of the water jacket upon the air during compression is quite small. In view of the fact that more or less loss occurs by leakage past the air piston and valves, it may, without any material error, be assumed that the cooling influence of the water jackets about offsets these losses, and the value of n should therefore be regarded as 1.408.

The number of stages which should be employed for compression depends upon the final pressure and the quantity of air to be supplied. When a large quantity of compressed air is to be supplied at a high pressure, an economical performance of the compressor can only be obtained by compressing in several stages for the purpose under consideration, the final pressure being 500 lbs. or more, the number of stages should not be less than three or four.

Assuming that the compression occurs in four stages, the following table shows the foot pounds of work expended upon the air for each cubic foot of compressed air stored at atmospheric temperature and different storage pressures, from 500 lbs. to 2,000 lbs. Indicating by w the foot pounds of work which may be done in the motor by one cubic foot of air stored at 500 lbs. pressure, the table also shows the relative amounts of work that can be performed in the motor by one cubic foot of air stored at the various other pressures. Also, representing the efficiency of any system, when operating with a stored pressure of 500 lbs. by E, the table shows the relative efficiencies of the same system with greater pressures of storage.

Storage Pressure by Gage.	Work Expended.(W) Foot lbs.	Rel've.	Work Restored by Motor.	Efficiency.
500 lbs.	300 600	1.	1.000 w	1.000 E
1,000 lbs.	724 100	2.409	1.971 w	.818 E
1,500 lbs.	1 201 300	3.997	2.943 w	.736 E
2,000 lbs.	1 714 800	5.705	3.914 w	.686 E

It will be seen from this table that the efficiency of the system diminishes very rapidly as the pressure of the stored air is increased. Whatever the system itself may be and regardless of what its actual efficiency may be under any stated conditions, the efficiency of that system will vary somewhat more than is indicated by the table. The reason for this is that the greater the pressure of storage the more difficult will it be to prevent loss by leakage, and consequently the incidental losses due to leakage, etc., will be increased by the higher pressures, with the result that there will be a greater difference in the actual efficiencies, with different storage pressures, than is shown by the table.

To indicate the fact that the conditions are less favorable to economy for all storage pressures, but especially so for the higher storage pressures, when the air is compressed in a smaller number of stages, the following table has been prepared for single stage compression:

Storage pressure by gage.	Work expended. (W) Foot lbs.	Rel've.	Work restored by motor.	Efficiency.
500 lbs.	461,500	1.535	1.000 w	.651 E
1,000 lbs.	1,217,500	4.050	1.971 w	.487 E
1,500 lbs.	2,134,000	7.099	2.943 w	.412 E
2,000 lbs.	3,169,600	10.544	3.914 w	.378 E

It will be seen by a comparison of the two tables that good commercial economy is absolutely out of the question without the use of suitable multiple stage compressing machinery. It will be equally evident that a system which might compare very favorably in point of efficiency with the electric trolley systems, when operating under a storage pressure of 500 lbs., would be hopelessly out of competition in this direction if operated with a storage pressure of 2,000 lbs.

Attention is called to these matters more especially on account of the evil influence of the wholly incorrect and misleading statements which have been made by those who desire to befriend the use of compressed air. It has been stated, by at least one writer, that the increased cost of supplying compressed air for storage at high pressures is insignificant in comparison with the advantage of the increased mileage due to a single air supply. In comparing the cost of compressed air power with that of horse power for street railways, such a statement may perhaps be excusable; but in comparing compressed air with electric power, such a statement is absolutely unfounded and is extremely dangerous, in that it may be influential in condemning the use of compressed air altogether in the event of the failure of the high pressure storage system.

It cannot reasonably be expected that the efficiency of the electric trolley system can be materially surpassed by that of a compressed air storage system operating under the most favorable conditions; and it is certain that it cannot be nearly approached by a compressed air system which stores air at such high pressures as have been recently proposed, or in which the compressed air is supplied by anything but a high grade compressing plant. It will be far better to store air at a moderate pressure and to attempt only a moderate car mileage between successive chargings. This will, in many cases, require additional charging points, which may be supplied either by additional compressing stations or by carrying the compressed air in pipes from a central compressing station to local charging stations; but there can be hardly any doubt that the cost of operation will, in the long run, be very much reduced by this plan.

Nothing is now said regarding any collateral advantages in the use of compressed air for street railway operation; it is simply desired to point out that there is a right way and a wrong way to place compressed air in competition with electric power. It is to be hoped that compressed air enthusiasts will not give the future of compressed air a black eye by adopting the wrong way.

RELICS ON THE BIG FOUR RAILWAY.

In correspondence with Mr. Schuyler Hazard, assistant engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway a remark was made that some time ago while in search of some information pertaining to the Mad River & Lake Erie Railroad, now the Sandusky division of the Cleveland, Cincinnati, Chicago & St. Louis Railway, he had happened to run across some old plans which he had found interesting as showing some features of the methods of construction employed in the early days of railways in the state of Ohio. The plans were forwarded to us and are reproduced here.

The Mad River & Lake Erie Railroad extends from Springfield, Ohio, to Sandusky, in the same state, a distance of 130 miles. The plans of the bridge construction in the absence of technical information are valuable only in a general way as showing the form of the structures and the method of supporting the stringers which carried the rails. The drawing of the track is of greater interest in that the method of framing and the arrangement of the members is

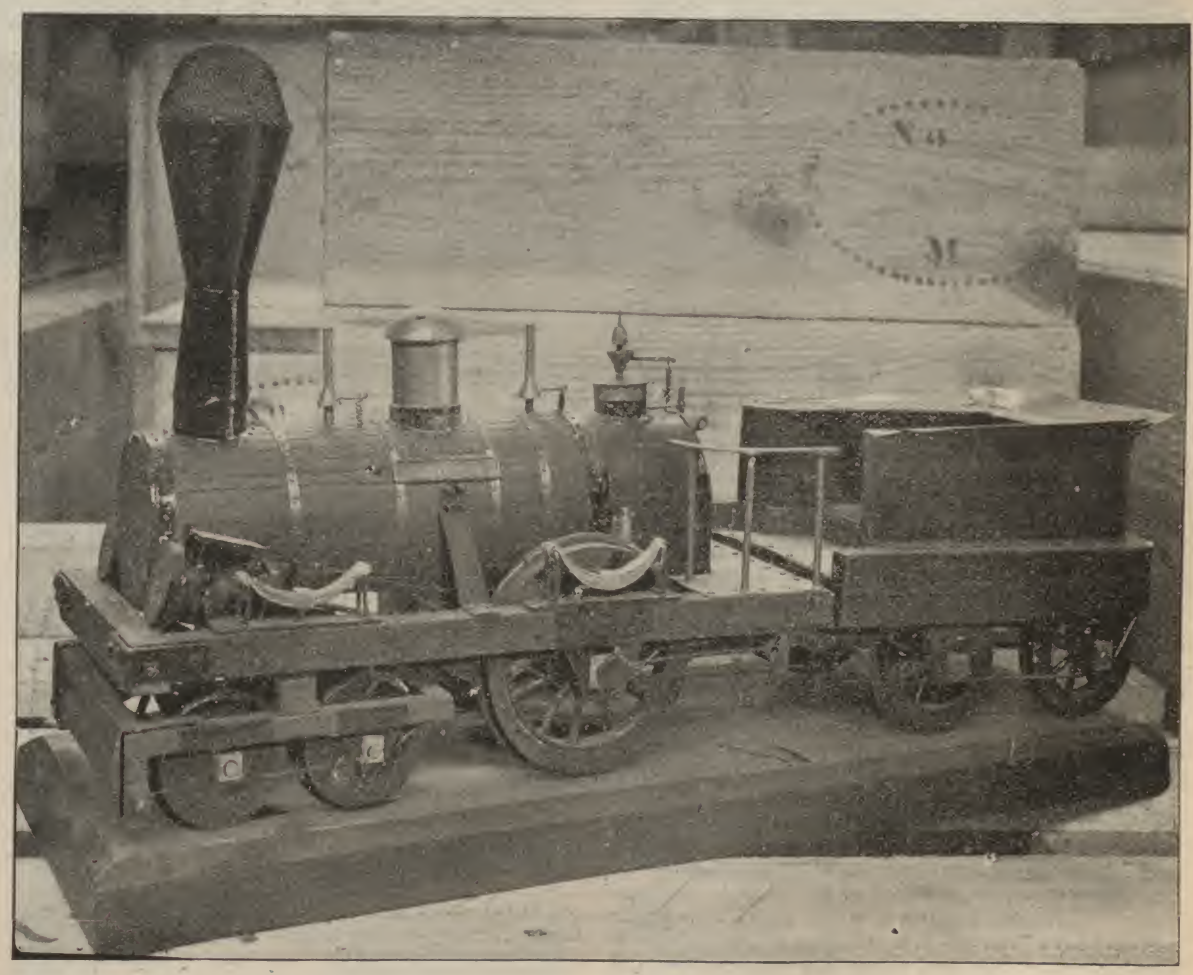


Fig. .—MODEL OF LOCOMOTIVE "SANDUSKY."

more clearly depicted. The rail itself is of the strap form, mounted upon a thin strip placed upon the upper and narrower of the two stringers which are continuous along the track. The upper stringer is hewn on four sides while the bark is left upon two sides of the lower one. The upper stringer is supported at frequent intervals upon cross ties of trapezoidal section and which are secured in place and give the correct gage to the track by tapered keys driven against the stringer and in a gain in the tie. These ties are laid with their broad bases downward resting on the lower stringers and they do not appear to be fastened to them in any way. The drawing would indicate that there was no ballast located as it is now, and this aside from anything else would

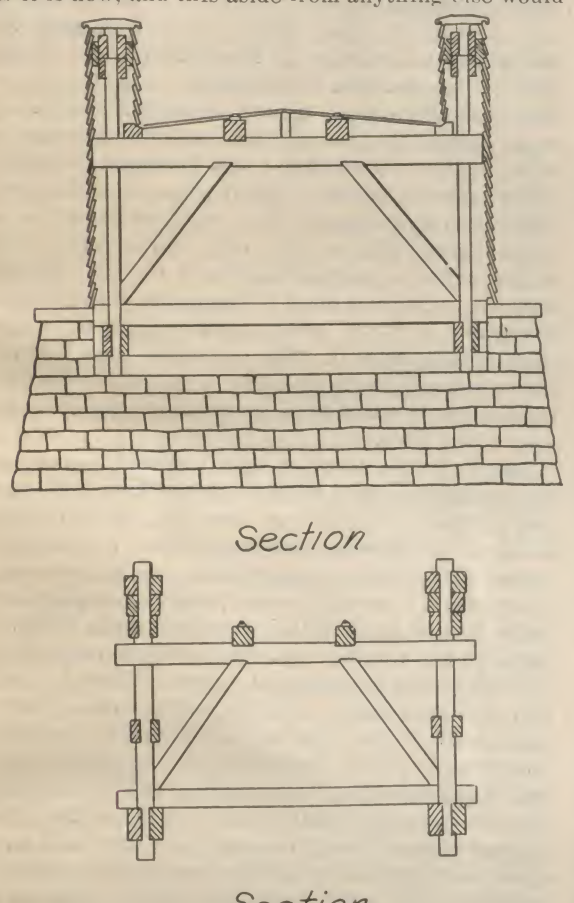


FIG. 2.—SECTIONS.

serve to limit the speed of trains. Trouble was probably had from the curling of the rail ends for which the tongue and groove rail joint and the proximity of the last spikes to the ends of the rails would seem to be provided. An idea of the proportions of the parts of the track structure may be had presuming that the drawing is to scale, from the fact that the gage of the track was 4 ft. 10 in. A section of the old strap rail has been preserved and is now in the office of Mr. Hazard at Cincinnati. The bridges were very strongly constructed and it would be interesting to know how long they remained in service but the records do not disclose that fact. The plan bears the date 1845, but it is known that the track such as is here shown was built in the year 1837 and 1838. Inasmuch as the bridge and the track structure were both shown on the same drawing it seems likely that they were drawn for a record.

Through the courtesy of Mr. G. Brown Goode and Mr. J. E. Watkins of the United States National Museum at Washington, a photograph of the model of the locomotive "Sandusky," has been received and from it the illustration in Fig. 1 was prepared. This locomotive was the first to perform actual service west of the Ohio river and was purchased by the Mad River & Lake Erie Railroad in 1837. A copy of the label attached to the model reads as follows:

LOCOMOTIVE "SANDUSKY."

Driving wheels, 4 ft. 6 in.; cylinders, 11 x 16 in.

THE FIRST LOCOMOTIVE IN THE STATE OF OHIO, 1837.

(MODEL.)

This was the first locomotive built by Rogers & Co., (then Rogers, Ketchum & Grosvenor,) at Paterson, N. J.

This locomotive was originally built for the New Jersey Railroad & Transportation Co., but not being accepted by them, was purchased by J. H. James, of Urbana, Ohio, president of the Mad River & Lake Erie Railroad. It was shipped by Canal, Oct. 14, 1837, and when it arrived in Sandusky—Nov. 17, 1837—not a foot of railroad had been laid in the state. The gauge of the "Sandusky's wheels—4 ft. 10 in.—thus became the established gauge in the state of Ohio.

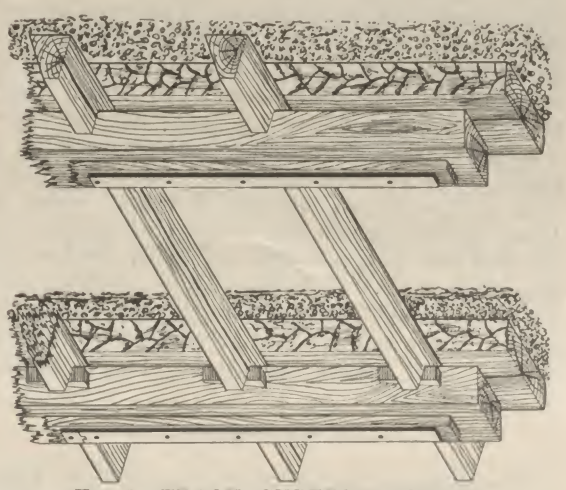
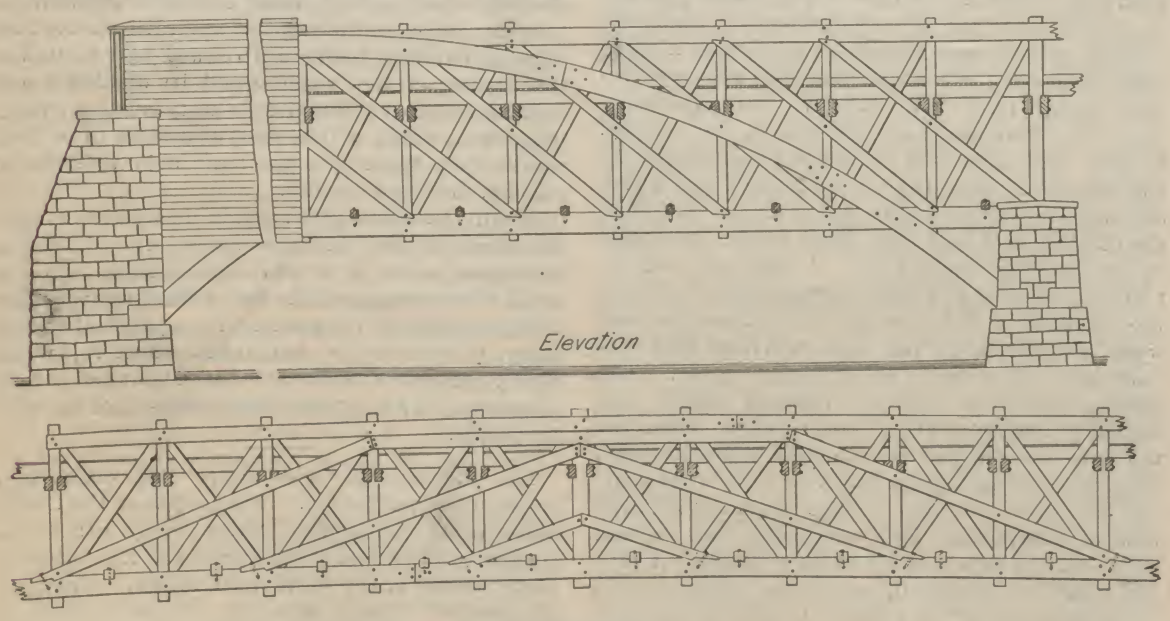


FIG. 3.—TRACK SUPERSTRUCTURE.

This shows that while the promotors of the Mad River & Lake Erie Railroad in the latter part of 1837 were sure enough of their undertaking to purchase a locomotive, yet not a foot of track was laid in Ohio until after November of that year. The right of way deeds for this division date from 1835 to 1850 and later. It is also interesting to note this example of the gage of the track in an important state having been established at 4 ft. 10 in. from the fact that the first locomotive happened to be of that gage. In this case the track was made to fit the locomotive instead of the reverse which is the order of to-day, and it serves to indicate how slight the influences were, as they are now measured, which caused the establishment of such important figures as that of the gage of the track. In speaking of this Mr. Hazard remarked that doubtless nowadays many in trying to develop high speed and great power wish that they might fix a gage more convenient for these purposes. This slip also records that the first locomotive was brought to its place of service by canal and relates the circumstances under which it was secured for the road.

From the source from which the other relics came an interesting letter was received which savors of, the days of strap rails when the up turned rail ends called "snake heads" caused a great uneasiness



OLD BRIDGE MAD RIVER & LAKE ERIE RAILROAD.—FIG. 4.—ELEVATIONS.

to travelers least they should be impaled in case the rail ends struck the wheels above the level of the axles. This letter is dated Washington, D. C., February 6, 1836 and was written by Mr. S. Mason, a representative of the state of Ohio, to someone whom he addressed as "Cush." It is reproduced accurately with the same spelling which appears in the original. Written as it was in the early times of railroading and by a representative, it shows the light in which railways were regarded and it is especially interesting to note the manner in which attention was called to the danger that the "affair would soon become a monopoly in the hands of a few enterprising capitalists." He refers in the first paragraph to a highway and later to a railway. The absurd notions of a railway then held are shown by the first part of the third paragraph in which he says "no one can travel on horseback or in a carriage of any description on a railroad, no matter how wide it may be or how finished. The steam engine and cars would scare any animal and drive it out of sight" and the question, "Could you drive live stock on such a road?" is equally indicative of the misunderstanding of the day with regard to rail transportation.

WASHINGTON, D. C., February 6th, 1836.

DEAR CUSH:—

The committee of roads and canals has come to a decision in favor of the road from Springfield to Richmond according to the prayers of the petitioners. The report will come in in a few years. I understand vinton will make the report, General Mercer the chairman was opposed to the change. This is a sorry business it will give me a great deal of trouble. I availed myself of the permission of the committee to lay before it a written argument against the change. I shall give the friends of the measure considerable trouble before they are done with it. But no one can predict the result. A report in favor of the change is very much against us of course. The same committee has under consideration the project of substituting a railway for the present road from Columbus to Mississippi.

General mercer and Vinton of the committee and how many others I know not are in favor of it. I understand the same subject is before a committee of our legislature.

There is a great danger in my opinion that the road will be overlaid by one scheme after another. I am opposed to all these experiments and as a railroad in lieu of the present macadamized road I have no idea that it will answer the purpose at all. No one can travel on horseback or in a carriage of any description on a railroad no matter how wide it may be nor how finished. The steam engine and cars would scare any animal and drive it out of sight. Could you drive live stock on such a road? No. Not within a half mile of it, the few that might escape being slaughtered by the engine in its passage through the drove would be frightened and driven into the woods where they would not be heard from again. For that reason a new road would have to be opened immediately to accomodate the people on the line. They could not go to the market nor anywhere else in the direction of the road. Besides, how is it to be kept up? Who is to superintend it? How long must people wait at the point where the cars start after they arrive there and are ready to pursue their journey? Would not the affair soon become a monopoly in the hands of a few enterprising capitalists? Is not the whole scheme wild and visionary? The United States will not make this road if the states refuse to take it after it is finished. The state of Ohio therefore cannot proceed too cautiously in this business—this untried experiment—in connection with this project it is said there is great danger that the states will suffer the present road to get out of repair and by neglecting it a short time it will be inadequate to put it again in complete repair. It is said that on the road from Zanesville to wheeling that the road between those points is greatly injured and now needs considerable repair. I hope the legislature will not permit this. Will you not ament the law so as to increase the tolls? There are too many exemptions. That road should not be suffered to delapidate, it would be wanton negligence in the legislature. The superintendent is a poor devil, I am told, we need a board of public works with a man just as vigorous as Kelly at the head of it.

It is a very great while since I have had the comfort of a line from you. We have no news here. Since Great Britain has undertaken to settle the difficulty between General Jackson and his cousin the king of the French we shall be cheated out of a war, and the majority in the Ohio Legislature will have nothing to do but to attend to domestic affairs. Still we shall be urged to make a large appropriation for national defense and the next fall elections.

Yours with esteem,

(signed) S. MASON.

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CHICAGO, SATURDAY, AUGUST 15, 1896.

LARGE iron and steel manufacturers have gone to considerable trouble of late to ascertain for their private information what the probabilities are of a better demand for certain products of their mills. Just what information they have they naturally decline to make common property. Just after these investigations were made, announcement was made of inquiries by large manufacturers for raw material for the remaining portion of the year. There is a desire manifested among many large interests to secure offers for the supply of material, and it is this phase the iron trade has taken within a few days. The possibility is shaping up that prices possibly have touched datum.

IN another column of this issue is a communication from Mr. E. D. Wileman, signal inspector of the Lake Shore & Michigan Southern Railroad upon the subject of colors for night signals. When Mr. Wileman first made the suggestion of the interchange of red and white in the present common practice of signaling, the idea was ridiculed and turned aside as a change which it would be impossible to even consider. His arguments, however, appear to be sound and the use of red for "all clear," green for "caution," and white for "danger," would seem to be consistent, satisfactory for operation, safe and cheap. It would add nothing to the cost of apparatus and the change would involve only slight alterations of the location of lamps upon the present semaphore poles. As far as is known no serious objection has been raised to this plan, and the system proposed seems to meet many of the difficulties of present practice with respect to lights. It is not likely, however, that popular sentiment among operating officers can easily be changed to admit of employing red as a clear indication unless the prevailing idea that the danger color must be the most striking one is overcome in favor of making the safety signal the most noticeable. It would be difficult if not impossible to entirely disassociate the red color from the idea of threatened disaster, yet this is not a satisfactory reason for not accepting what seems to be a simple and effective solution of the problem. Space is cheerfully given to Mr. Wileman's argument for the reason that he is believed to have rather strong grounds for his recommendation, and his suggestion is well worthy of thoughtful consideration. It is not absurd and is worthy of more attention than it received during the discussion of Mr. Gibbs' paper on "Modern Practice in Signaling" at the March, 1895, meeting of the Western Railway Club where it was first proposed. We shall be glad if this communication has the effect of calling out criticisms upon the scheme.

THERE are many different recommendations on record as to the proper method of procedure in case of the overheating of steam boilers which may be said in almost all cases to be due to shortness of water. A committee of foreign engineers was appointed some time ago to report on the proper program to follow in such cases. The members of the committee agreed that overheating was to be remedied best by a good supply of water and it was recommended that the boilers should always be refilled in such cases, no matter whether the deficiency arises from leakage or from a failure to properly attend to the feed. It was considered dangerous to rake out the fire but the opening of the fire doors was recommended for the purpose of cooling off the furnaces, and also water may be turned on to the live coals which was considered safer than an attempt to rake out the fire on account of the temporary increase of temperature which would follow a disturbance of the coals, and with boilers having large heating surfaces the increase in temperature would be specially dangerous. The committee advocated strong feed in any case with low water whether the plates show heating or not. With this recommendation however it is difficult to agree because of the danger in case of cold water being brought suddenly into contact with heated plates. If injectors or feed water heaters are used the feed will not be cold but its temperature will be so much lower than that of the sheets as to endanger them. The danger is not only one of destruction of the plates themselves for if a plate is cracked by contact with cold water it is likely to let go with the usual result. The safest plan is to avoid all increase of danger which is always serious enough with overheated boilers, and the best way to do this is to extinguish the fire and blow off steam. It is surprising that this course should not be universally considered as the only one to be pursued under such circumstances but it seems that the danger of feeding against hot plates is not fully appreciated.

OCCASIONALLY in equipment of a machine plant breakages occur to large castings which unfit them for use, and yet do not apparently require much repairing to render them as useful as ever again. The process of grafting of cast iron would be very useful in such cases if it could be relied upon to give satisfactory results with respect to the strength of the repairs and the possibility of making the casting as true as it was before. Several years ago an attempt was make in a large locomotive shop to repair a steam hammer frame by the grafting or "burning on" process, and after several trials it was given up because of the difficulty of obtaining a good splice. The exact cause of the failure is not known, but probably if the method described by Mr. W. L. Hayden in a recent issue of *The Foundry* had been employed the casting would have been serviceable and the repairs might have been made upon a profitable basis. The work described was the grafting of wabblers on the end of three eight-inch train roll-spindles, and as there is a high torsional stress upon these parts during the rolling process, its success in this case speaks well for its thoroughness. The essential features of successful grafting, as taken from this instance are: perfect cleaning of the part to which the attachment is made, all rust and foreign matter being removed: good iron for pouring the graft; a sufficient quantity of molted iron and an arrangement by which the melting of the part to which the grafting is made shall be insured, and a sufficient time allowance before taking from the mold to secure annealing of the new and the old portions of the casting. In this case, after the broken end was chipped off and cleaned a mold was made for the new part which also fitted the old part and acted as a mold to confine the portions of the old roll, which should be melted by the incoming melted iron. A tap hole was cut through the mold at a point in what might be termed the junction of the new and the old portions, and when all was ready the mold was filled with cold blast iron, which was as hot as could be made. The pouring continued until the original casting was melted to a depth of about three inches, when the tap hole was plugged and the piece allowed to cool. The rolls were left in the molds for a day after pouring and when put into service again two hundred tons of quarter-inch rods were rolled from one and three-eighths inch billets without a mishap. Grafting which is successful, as this was, pays, and it is a process which would probably be used oftener if it could be depended upon. It would seem to be applicable in some cases of broken locomotive cylinders and saddle castings, and where it can be used the saving in labor over other forms of splicing or strengthening would seem to be a strong recommendation.

A QUESTION OF PATRIOTISM.

Business and politics are now inextricably mixed up. However important or desirable it may be, as a general proposition, to keep them separate, it cannot now be done. The tariff issue in politics opened the way, and it has been followed by an issue infinitely more grave because more radical. Protective tariff is a question of policy only; there is nothing involved but expediency. "Free silver" or "sound money" is a question of principle. Rightly understood it is dishonesty against honesty. We do not mean to infer that all who advocate free coinage of silver at the ratio of 16 to 1, are dishonest at heart. We do believe however that if after full and careful study and investigation, they continue to believe in and advocate such a law, they are afflicted with either mental or moral obliquity of vision. We believe that the great mass of the people of the United States are at heart honest, and will do the right thing if they know it. The trouble is that "Israel doth not know; my people do not consider." To help them to know, to lead them to consider is therefore the duty of the hour.

THE RAILWAY REVIEW is a technical paper, but by no means confined within narrow lines. Its general province is to discuss from the highest standpoint of intelligence and experience, subjects connected with railway construction, maintenance and operation. Naturally and properly engineering topics occupy much of its space, because of their importance and the fact that these subjects can only be handled properly in special papers edited by properly qualified men. Traffic matters also involve much more of the "technical" than is generally understood. Their treatment by the press in general is characterized by prejudice and misinformation. A railway journal which does not confine itself to some narrow line of mechanics, should and must consider subjects of political economy and sociology which are of as vital importance to the railways as to other large business interests—although there may be no lack of other periodical literature treating these themes thoroughly and well. The relations of capital and labor cannot be ignored in their general aspects; and, in fact, there is no vital problem in modern business life, which railway owners, managers and employes can afford to wholly ignore. The railway itself has come into most intimate relation with every phase of civilized life. Religion and education are almost as dependent upon it as commerce, whose special ally it is generally considered.

With no intention or desire, therefore, to become a political organ, or to lend itself in the least to the purposes of partizanship, the REVIEW feels that it is honestly bound to take sides in the present national political conflict over what is known as the "silver question." It believes that the existing monetary standard of the United States should be maintained; that free coinage of silver at any ratio except that actually existing between silver and gold bullion in the markets of the world would be dishonest and ruinous; and that national dishonesty must inevitably bring ruin, which will be most disastrous in its final results upon those who are least able to stand it, namely, the wage earners.

It will, therefore, give room in its columns to such statements of fact and such arguments as it deems sound and worthy of careful consideration. It will avoid vituperation and the use of those weapons generally considered inseparable from political controversy, which though sometimes effective, would hardly comport with the sober argument and careful judgement which are the proper weapons of thoughtful people.

The advocates of "free silver" lay claim to a monopoly of patriotism. They say that the United States is big enough and strong enough to act independently of the rest of the world, and that where it leads the rest of the world must follow. They protest against "outside dictation," and strenuously insist that commercial independence is as much a right

and a duty as political independence. The familiar bugaboo of "British gold" is again brought to the front to arouse the so-called "Americanism" of voters. Bluster and buncombe are not new weapons and will not prove effective in this age of the world. It is time they were sent to join the "stink-pots" of ancient warfare.

The soldarity of the world of to-day is not a matter of sentiment—it is fact, whether we desire it or not—whether we are broad philanthropists or the narrowest of the selfish, it exists. It has been brought about principally by the inventive genius and the commercial spirit of the nineteenth century. No portion of the world is now or can be commercially independent. The net work of rails on the land and of well-traveled roads on the sea, is like a nerve system. A sensation at one point travels more or less sensibly to every other point. Wars, floods, panics, disasters of every kind are no longer local in their effects. Sooner or later, in one way or another, the wave of their effect reaches to the uttermost. The loss of one country may be, for the time being, the gain of another, but the adversity or prosperity of one is felt in some way by all. The wheat crops of India, Russia, Argentine and the United States are practically pooled; that is, the price is regulated by the average yield. No possible legislation in the United States could fix the price of wheat, except limiting production. So with the "crops" of silver. Excessive production lessens the price: and as the means of distribution are so easy and perfect, the country which pays more for it than others will quickly be "loaded up." Silver will flow to it like wheat or any other product as long as the price is above the average, and the country has gold or other exchangeable products with which to pay for it.

This world wide self-adjusting commerce of modern times demands a uniform medium of exchange, acceptable everywhere for its value in weight and not dependent upon the stamps placed upon it by any government. The only such medium is gold, and the most enlightened nations use it as their sole standard. Other nations may have a silver standard or a copper standard for internal use; but international business is upon a gold basis and must so remain. The subsidiary coin used in the domestic commerce of any country may be "token money;" that is money the bullion value of which is less than its stamped value. This token money is good for its face only because and as long as the government issuing it can and will maintain by exchanging gold for it. Outside of that country it is exchangeable only at its bullion value, unless it can be shipped back to its home by money dealers and gold obtained for it.

As soon as any country issues such silver, copper, iron or paper money in excess of its home demand and of its ability to redeem it in gold, it depreciates, no legislation can stop the tendency of goods to seek the highest market. The silver of the world will seek the highest price, and the gold rapidly leaves any country which does not maintain it as the monetary standard.

Now what is the standard of the most enlightened and strongest commercial nations? The countries on a free silver basis are Mexico, some of the Central and South American republics, Japan, China, Russia and India. Japan and Russia are progressing in enlightment and are preparing to change to the gold standard. Can the United States successfully maintain silver with the very weak help of the remaining ones of this list? Does the condition of Mexico, China and India afford much encouragement? Why should we join the semi-barbarous and bankrupt countries of the world in an endeavor to control the world's commerce? The inevitable result would be ruin, and well-deserved ruin, because it would be the result of repudiation and dishonesty. The United States must and will stand with the most enlightened and progressive countries. It aspires to lead them, to make the most of its free institutions and its tremendous natural advantages. To do so it must have the best money in the world, not a depreciated currency worth only one-half of what it claims to be worth.

True patriotism will be content with nothing less; and it is the most unpatriotic action imaginable to to attempt a commercial declaration of independence which cannot by any possibility be carried into effect except at the expense of ruin and degradation

GAS POWER TRANSMISSION.

Since the completion of the water power tunnel at Niagara Falls the predictions of the transmission of the power of the falls to fabulous distances have been plentiful. Electric or compressed air power transmission through long distances economically has not yet been achieved and the difficulties seem so great as to be insurmountable. Improvements may be made in the apparatus and the use of currents which will enable them to be transmitted with less loss and with a reduction in the amount of conducting material required. The cost of the copper conductors now operates heavily against the transmission of electric power and it seems advisable to look elsewhere for the solution of the problem. The question is important and affects large interests because of the cost of power in cities which are sufficiently removed from the coal fields to render the cost of transportation of coal an important factor. The vast accumulation of the small grades of anthracite coal in the mining regions has attracted attention as being a possible source of power which might be economically transmitted to points where it could be used to advantage and without the necessity of moving the coal.

Several plans have been suggested looking toward the utilization of this fine coal or culm, as it is called, with electrical transmission of the power obtained to points where it should be applied to manufacturing. These plans are largely visionary and do not work out well, even on paper, when all of the factors of expense are considered. A suggestion has been made by Mr. Nelson W. Perry which would seem to be practicable and promising of profitable results. He would use the culm for the manufacture of gas and transport that by means of pipes to reasonable distances where it could be used in different ways for the production of power. Mr. Perry's ideas on this subject were embodied in a lecture delivered by him before the Franklin Institute and published in the journal of that organization. There are principles involved in this form of power transmission, for such it is in a true sense, which may be interesting to those who have no large culm banks but have reason to employ some means of transmission on a more or less extensive scale.

This author shows that the amount of clean coal that went into the culm banks in the district of Scranton, Pa., up to and including the year 1891 was 21,975,444 tons which was figured upon a waste of 20 per cent. The estimated total production of this district for the year 1891 was 6,193,390 tons and if one fifth of such an amount goes to the culm bank there is an annual flow of 1,400,000 tons to that repository. He quotes Emery as estimating 14.4 tons of coal per annual horse power for 365 days of 20 hours each for a simple, high speed non-condensing engine and upon assuming a loss of 22 per cent due to the fine coal he figures that with culm a horse power could be produced for 18.5 tons. This would lead to the conclusion that 75,672 horse power is now going to waste annually in the culm pile and this is nearly equal to the capacity of the Niagara tunnel. But in addition to this the accumulation of culm is placed at 1,100,000 horse power years which represents the amount of power stored in these piles of fuel. The cheapness of the fuel is not surprising in view of its having heretofore been considered an encumbrance. It is said to cost from 25 to 30 cents per ton on board cars at the breakers and it is worth 10 to 15 cents per long ton in the banks. Transportation increases the cost so rapidly as to make the original price almost insignificant and the importance of using it at the banks is apparent. Mr. Perry tells us that the only preparation which these refuse heaps require before utilizing for steam purposes is proper sizing and that this may be cheaply effected by passing the material over screens which separate it into grades of uniform size, the uniformity being the chief requisite for use under boilers since the introduction of improved grates and air blast systems applied to sealed ashpits. The fineness is not now troublesome and the coal as fine as dust may be successfully burned. With one of the improved grates a horse power has been produced for 365 consecutive days of 24 hours each at Scranton for $22.00 and for a year of 313 days of 10 hours each for from $13.00 to $14.00.

Better results, however, are looked for by the production of gas from the coal at the mines and while formerly producer gases were incapable of transmission to any considerable distance, the introduction of water gas processes has made it possible to manufacture gas more cheaply and also to transmit it through pipes without condensation. The Dowson process has been improved to such a degree as to permit the manufacture of gas at about six cents per 1,000 cubic feet, and Mr. Dowson is quoted as estimating the cost of gas producers at about $11.00 per horse power, but Mr. Perry believes that they can be built cheaper than that in this country. Mr. Perry mentions the fact that electricity is not our cheapest method of transmitting energy and illustrates this by stating that with ordinary sixteen candle power gas, 3,000 horse power can be sent a distance of one mile for an expenditure of one horse power which is an economy far exceeding that of any other method, being but one-thirtieth of one per cent of the power conveyed. As to cost of mains, he shows that the expense of conductors on the low pressure culvert system is $27,500 per mile for the conveyance of 1,080 amperes at 110 volts, the power being 158 horse power. It would require two of these mains to transmit 300 horse power while a six inch main would convey enough ordinary gas for that power at four inches pressure and at sixteen inches pressure it would deliver as much power as four pairs of such conductors. The pipe would cost $2,500 per mile while two pairs of low pressure conductors would cost $55,000 and four pairs would cost $110,000 per mile. Again, the loss of electrical transmission is ten per cent or 300 horse power in the case assumed wherein the transmission of gas would have a marked advantage.

The following is quoted in Mr. Perry's own words: "When the fuel is delivered in this form it is adaptable to all of the uses to which fuel is ever applied. It can be burned under boilers for the raising of steam for power or heating purposes, or it can be applied to domestic uses, or it may be used directly to advantage in gas engines. In no case need there be any stand-by losses, such as are inevitable in solid fuels; for when the fires are wanted it is only necessary to turn on the gas, and when they are no longer needed it may be turned off, and there are no ashes or coal to be handled. For power purposes a somewhat extensive investigation of the question has satisfied me that, if we can procure cheap gaseous fuel the gas engine is the proper thing to use, especially in situations such as are found in our electric lighting stations and elsewhere, where the load is variable between wide limits. In such situations a portion of the boiler plant must lie idle during the hours of light load, and it has been estimated by very competent authorities that the consumption of coal of the idle boilers amounts to ten per cent of the total consumption of all the boilers. With the gas generator the stand-by losses are so small as to be negligible in comparison, so that a direct gain in economy is here attained."

While Mr. Perry's subject was specially connected with the utilization of the refuse fuels there is much in his argument which has application to other questions of transmission of power about individual works, and what he says concerning the stopping of the waste while the gas plant is shut down will bear turning over in the minds of men who are operating large and scattered shop plants.

Western Society of Engineers.

A regular meeting of the Western Society of Engineers was held in the society's rooms at 8 o'clock, Wednesday evening, August 5th, 1896. Mr. Ossian Guthrie read the paper of the evening—"Relics Turned up in the Chicago Drainage Canal". Professor Charles H. Ford, who has devoted considerable time to investigation and study of the geologic features of the canal, was present with a number of photographic views, of a variety of peculiar formations found there, with which he supplemented his entertaining talk on the subject.

At the board of direction meeting held July 23, the names of Mr. Joseph Ripley and Charles H. Bell were favorably reported upon by the membership committee. The resignation of Mr. Henry Goldmark as secretary was received and accepted. Action to elect a successor was deferred until an expression of the whole board could be had. At the board of direction meeting held August 6th, Mr. Jos. Ripley and Mr. Charles Hillary Bell were declared elected to active membership. After duly canvassing the question of secretary, Mr. Nelson L. Litten was unani-

mously declared elected to that office. The secretary was instructed to incorporate with the next published proceedings the calender of papers to be read before the society as arranged by the committee on professional papers, which is as follows:

August 19th—"Notes on Coal", C. F. White.
September 2—"Street Pavements in Chicago", C. D. Hill. Discussion, R. E. Brownell.
September 16—"Parks and Roads", H. C. Alexander. "Parks and Roads", J. F. Foster.
October 7—"Railway Yards and Terminals", H. G. Hetzler.
October 21—"Steel for Boilers and Fire-boxes" T. L. Condron. "Steel Forgings", H. F. J. Porter.
November 4—"Medical Treatment of Men on Engineering Work", Dr. S. W. Maphis.
November 18—"Cableways", Frank B. Knight.
December 2—"The Equipment of Manufacturing Establishments with Electric Motors and Electric Power Distribution", D. C. Jackson. "Electric Traction", Edward Barrington.
December 16—"Modern Pumping Machinery", E. E. Johnson.

"Remonetize" Pig Iron.

The Atlanta Journal publishes the views of a gentleman of that city (Mr. A. P. Hull) concerning the "remonetization" of silver, which is commended to the consideration of those who deplore "the crime of 1873:"

Having been deeply impressed by the arguments of Judge Crisp, Bryan, Stewart, Jones and other silver leaders, and especially grieved, shocked and horrified by the "awful crime of 1873," as so luridly depicted daily in the columns of the Atlanta Constitution and other silver organs, I have changed my views on the money question, and am ready to maintain the propositions following in joint debate or newspaper controversy.

I accept the arguments of the advocates of silver and agree with their remedy as far as it goes. However, it does not go far enough. Let us have plenty of remedy—in fact, enough to make debt and poverty things of the past, relics of the dark ages.

I am in favor of the free and unlimited coinage of pig iron at a ratio of 16 to 1 with gold by the United States alone, independently of all nations, and can prove by the best authority obtainable that such a policy on the part of the United States will "raise prices," "put plenty of money in circulation," and give the "honest debtor a chance to pay his debts," thereby making the whole country prosperous.

Now in the first place, it may be urged by some "who do not understand the subject of standards of value" that a free-coinage act for iron would not raise its price to a ratio of 16 to 1 with gold. To them I reply that "the stamp of this government" and the "legal-tender qualities" of the iron dollar would instantly make the bullion value of pig iron the same as the mint value. "For who would part with an ounce of this precious metal for anything else than the mint value?" (Stewart, Jones and Bryan.)

Again, it may be urged that our mint would be overcrowded with pig iron. I reply that the price of pig iron having been raised from $7.50 a ton to a ratio of 16 to 1 with gold the world over, "no one would especially care to carry it to the mints, since the mint price could be obtained anywhere in the open market." (Atlanta Constitution.)

Next, it may be urged that gold and silver would go out of circulation. I reply first, "This is a mere assumption of the tools of the money power which they cannot verify" (Atlanta Constitution), second, "Suppose gold and silver do go out of circulation, is there not plenty of pig-iron to take their place and give people plenty of money?" (Bryan); and third, "Such an assumption mixes ideas of circulating medium and standard of value; gold and silver would still be potential money metals, though not in circulation, and would lend their help toward raising prices and causing general prosperity." (Crisp.)

Then, again, it may be urged against the pig-iron standard of value that wages would not rise in proportion to prices. The reply is, "Wages would be compelled to rise, no man would be fool enough to work for $1 a day who could make $1,000 per day picking up rusty nails and old horseshoes and carrying them to the mint for coinage." (Hull.)

In addition, it may be urged by the money power, by the "Wall street sharks" and the "Bond street Shylocks" that we could not alone go on a pig iron basis without an international agreement. "To such dastards as dare to lay a limit to the power of the American people to do what they please, independently of all nations, I hurl their cowardice and lack of patriotism back in their faces." (Bryan.)

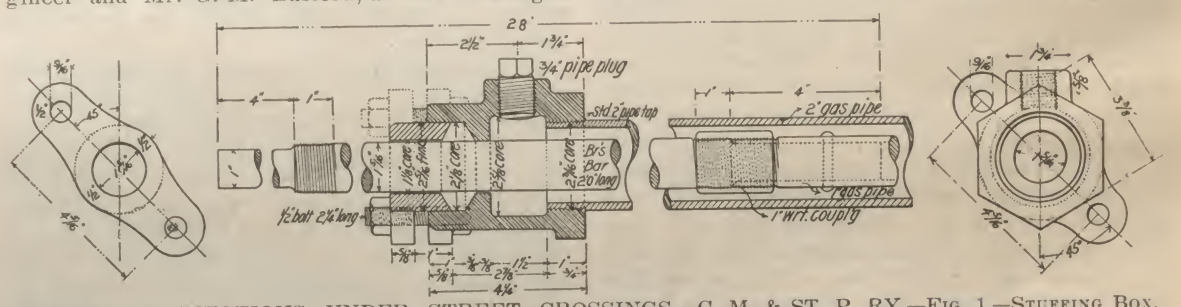
The "crime" of demonetizing pig iron took place about 2,200 years ago, when certain "goldolators" and "silverites," in order to increase the purchasing power of their ill-gotten wealth, secretly and "like thieves in the night," got the demonetization act passed repealing the good, old free coinage act of Lycurgus, the "friend of our ancestors' daddies." To-day China is the only country on earth honest enough to coin iron, and there the happy laborer can carry home the wages of his honest toil in a wheelbarrow.—(Atlanta Constitution.)

A ruinous fall in prices followed the demonetization of iron and has continued for upward of 2,000 years. I have calculated the losses entailed upon the honest people of this world by that ruthless act, but the figures are so enormous I fear a revolution will ensue if the people learn how greatly they have been robbed. But facts are facts, and the best way to right a wrong is to meet it squarely. "That loss is $21,000,000,000,000,000,000,000,000,000,000." ("Coin's Financial School.")

In conclusion I insist that the free coinage of pig iron will do everything that is claimed for silver and infinitely more. The people will be rich and prosperous. The once poor man can pay his debts with his old stove. Railroads can declare dividends on old rails and worn out rolling stock. The small boy can pick up old nails and horse shoes enough to support his family. In fine, poverty and debt can no longer exist.

SIGNAL CONNECTIONS UNDER STREET CROSSINGS.

The Chicago, Milwaukee & St. Paul Railway enters the city of Milwaukee over a number of grade crossings many of which are also crossed by electric street railway tracks. There are four interlocking plants distributed among these streets and in all cases the pipe line connections are required to run under the streets and at such a low level as to be very troublesome to drain in the winter when the boxes fill with mud and water which freezes and blocks the pipes. During the winter of 1891-92 in spite of efforts to keep the boxing tight the pipes were frozen up several times and required digging out at considerable expense and delay to the operation of the plants. To do away with this difficulty a plan was decided upon by Mr. Geo. Gibbs, mechanical engineer and Mr. G. M. Basford, at that time signal



SIGNAL CONNECTIONS UNDER STREET CROSSINGS.—C. M. & ST. P. RY.—Fig. 1.—Stuffing Box.

engineer of the road, which has been in constant use for over three years with entirely satisfactory results.

For trial two stuffing boxes and plungers were made from the drawing from which the accompanying illustration Fig. 1 was prepared and they were placed at the ends of the boxing which extended across the most troublesome street. These plungers were of brass and 28 in. long by $1\frac{5}{16}$ in. in diameter with one inch pipe threads cut near each end, the ends being elongated in the form of plugs for the attachment of the signal pipes by the usual method of riveting in addition to the attachment by means of the screwed couplings. The signal pipe was then passed through a 2 in. gas pipe which extended between the plungers, the object of which was to form a jacket for the reception of oil in which the

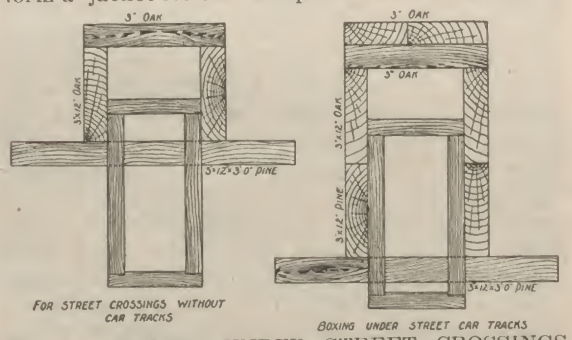


Fig. 2.—BOXING UNDER STREET CROSSINGS.

signal pipe might work in preference to running upon the usual pipe carriers. The stuffing boxes served to retain the oil and confine it to the 2 in. pipe. The stuffing boxes are of cast iron and are screwed upon the ends of the large pipe. After the signal pipe was connected up to the plungers at each end and the glands which are of brass were in place and packed, the ¾ in. plugs were removed and the space between the signal pipe and the jacket filled with a light hydraulic oil which is not effected by cold. The plugs were replaced and the boxing does not need to be taken up though it may pack solid full of mud which may freeze and yet give no trouble.

Mr. W. H. Elliott, signal engineer of the road writes that the only difficulty which has been experienced with the device was from an accidental puncturing of the jacket pipe by section men in repairing the crossings but this has been remedied by the use of the heavy boxing with a layer of 3 in. oak plank on the top as shown in Fig. 2. This illustration shows two forms of boxing for street crossings, one where electric roads cross the steam line and the other for ordinary crossings. For the street car crossings the boxing is two feet deep the extra depth being necessary in order to carry the pipes below the rails of the street car lines which are usually about 10 in. deep. There are now 26 of these stuffing boxes in use on that road and it is believed that a similar plan might be followed with advantage in many other places where there is difficulty in keeping mud and water from signal connections.

A WAY OUT OF THE SIGNAL COLOR DIFFICULTY.

To the Editor of the Railway Review:

Every one connected with railway signaling recognizes the fact that the question of what are the safest colors for night signals is one of the most troublesome problems in signaling which awaits a satisfactory solution, and I venture to predict that it will continue to be so until we change the spirit in which most of us approach its consideration. Past practice and prejudice are allowed to rule to the almost total exclusion of logical analysis. Let us look at the probable reasons for the adoption of red as the danger signal, and see if equally good reasons cannot now be found for a radical change. The first attempt at a railway was probably a short single track with only one train and all the work was done by daylight and no signals were needed. As time went on, growth brought complication, till some serious accident drew attention to the fact that it was necessary to have some means of announcing the dangerous condition of any piece of track, to an approaching train. It was natural enough to still assume that everything was safe unless the contrary was shown. On such a basis, of course, the only logical thing to do was to pick out the most striking color possible, as the danger signal. This, I think, we may safely assume to have been the way in which red came to be the danger color indication.

Were it possible to have all our present complex conditions of heavy traffic, with block signals, interlocking, and the various special signals present on any well regulated trunk line, and have the question of color still an open one to be decided on its merits, unbiased by any past practice, I feel perfectly safe in saying that the decision would hinge on two points, first, the adoption of the general rule of practice to proceed under control unless the route is clearly shown to be safe. Second, a natural sequence of the first, to make the safety indication the ruling signal, hence the most prominent and striking, also one which it is impossible to produce by accident. All of which is nearly the reverse of our present practice; and these advantages would be best obtained by using red for safety, green for caution and white for danger. Although such a change is radical, its benefits are equally so, and for economy and ease of execution in the change, I think, it cannot be excelled. All that is needed on present semaphore posts is to raise the lamp bracket so that the lamp shall be exposed when the blade is at danger and covered by the spectacle when at "all clear". In the case of rotary lamps it is only necessary to shift the lenses, that being in most of the lamps a matter of but a few moments work.

I will now recite a list of possible accidents that will under the present system give a false and dangerous indication, but the recommended change would render it impossible to give a safety indication until the fault had been corrected. 1. A broken glass in the spectacle. 2. The spectacle breaking off and falling down. 3. The movement of the blade being held by a wire lock so that only about ¼ of the movement was made. 4. The effect of a very sudden cold snap on a selected signal pulling two or more blades down just enough to show a white light and destroy the red. 5. The obscuring of a red glass by ice and snow so that it looks like a dim white light. There is also a strong point in favor of the recommendation from the necessity of better adjustment, as added care and accuracy with the signals would be sure to reflect on the rest of the plant.

The chief objection I have heard urged against the change is the danger of irrelevant white lights confusing a runner. If that would be the case why do we never hear of ordinary street lights, etc causing accident by being taken for safety signals? It is far less dangerous, for a runner

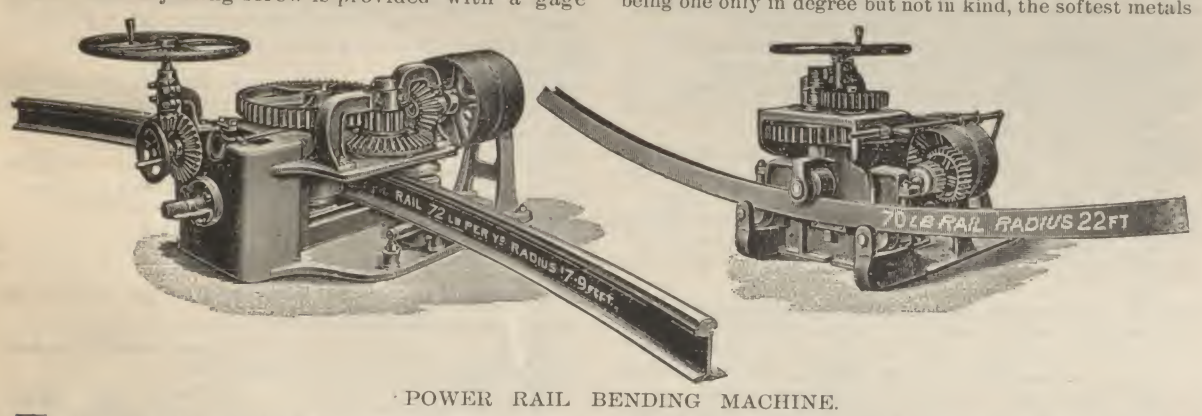
to make a danger signal out of a stray light and stop, than it would be for him to make a safety signal out of the same stray light and go ahead when he should have stopped. E. D. Wileman,

Signal Inspector L. S. & M. S. Railroad.

[Comment upon this suggestion will be found in the editorial column of this issue.—Ed.]

POWER RAIL BENDING MACHINES.

The accompanying illustrations show the general appearance of a new design of rail bending machinery which appears to have some very good points to recommend it. The machines are portable and designed to be driven by belt power. The one shown in Fig. 1 is designed for use in bending rails for either street or steam railroads, and carries the rail in an upright position, the base resting on rollers. The machine shown in Fig. 2 is designed for use in bending rails for steam roads only, and in it the rail is carried on its side. The principle of construction of the machines is the same. The rail to be curved is forced between three rollers, the central one of which may be adjusted by means of a hand wheel for regulating the amount of curvature given the rail. The adjusting screw is provided with a gage



POWER RAIL BENDING MACHINE.

for indicating the amount of curvature given, without making frequent measurements. This roller is when desired, adjusted by means of an hydraulic jack instead of compound gear and screw. The machines are also built with steam cylinders or electric motors for driving instead of a belt, and when steam is used can be designed for taking the necessary supply from a locomotive boiler. It will be noted that metal is not stinted in either machine and they are sufficiently powerful for meeting the heavy strains to which they are subjected. It is claimed by the inventor, Mr. Geo. E. Smith, of Sherbrooke, P. Q., Canada, that they have a capacity of one rail per minute.

TEST SECTIONS.*

By P. Kreuzpointer.

In view of the growing conviction among engineers of the desirability of uniform methods of testing the materials of construction, and since this matter is so broad and deep that no one man can survey and fathom it all, a short conversation with Science, Experience and Economy about the subject under question may not be without interest. The remarks made at the last congress, at Zurich, of the International Society for the Unification of Methods of Testing of Materials of Construction, by Mr. Schroedter, secretary of the Society of German Ironmasters, illustrate very clearly the desirability of a discussion of the various phases bearing on this question. He started out by saying:

"The specifications for iron and steel for all kinds of construction vary not only in the different industrial countries, but on closer examination of the details of the individual specifications an extraordinary difference is found. A few examples will prove this assertion.

"While in one case bending and drop tests of a rail are considered sufficient, we find in another case specifications for chemical analysis or tensile test. While a strength of 72,000 lbs. per square inch is asked for in one case, another buyer prescribes 112,000 lbs. per square inch. For structural material, which is used in hundreds of thousands of tons for bridges and buildings, one engineer asks for a material of 57,000 lbs. per square inch, with an elongation of 20 per cent in eight inches, while another one asks for a strength of 71,000.

"Still greater differences are found in specifications for sheets and steel castings. Not only are there great differences for quality, but there are also no uniform methods of testing and inspection."

The great variety of specifications for the same material for the same purpose seems to indicate a variety of opinions among engineers of the properties and behavior of metals. As a consequence we have a multitude of methods and specifications for testing and inspection of materials of construction. In one point, however, there is uniformity of opinion—namely, that the testing of full sized structures or members of structures would give the most reliable insight into the quality of materials. Science demands the largest sized test piece to satisfy her wants fully. However, Economy steps in at this point and says that this cannot be done because it would be too expensive in labor and material to make the testing of large masses a regular practice. In our perplexity we go to consult Experience for advice. And right well we did in asking her opinion, for she told us that, while it is of course quite satisfactory to test full sized material, she knew from closely observing the properties of metals that it is not necessary for practical purposes to go to that expense; but she was sure that a piece of metal of a suitable size, taken from the material intended to be used, would give us safe and reliable information for nearly all of our needs. If, however, Experience continued, we go below that size we get on the wrong path, and the further we depart from the proper point or source of information the more are we led astray and run the risk of accidents and injury, if not disaster.

Why, do we ask, should this be so? Because, Experience tells us accommodating as metals are in very many ways—more so than many an engineer has any idea of—they are very set in certain characteristics, one of which is an objection to be interviewed and interrogated in a way that circumscribes and hinders free expression and movement. If put too much under restraint while being examined metals are very apt, says experience, to assume a strained, unnatural position, appearing to the examiner to be something different from what they really are. The main point to be borne in mind Experience continues to explain, is that all metals are plastic; the difference of plasticity of the different metals being one only in degree but not in kind, the softest metals being the most plastic. As a consequence, our method of testing and examining must be such as to give a metal the greatest freedom to exercise its plasticity or else we get erroneous results. Hence the importance and necessity of reading and interpreting elastic limit, yield, point tensile strength elongation and contraction of area rightly and correctly, because these phenomena are functions of the plasticity of metals, and if we obstruct plasticity we alter those factors by which we measure the worth and value of a given metal for a given purpose. And to the degree these factors or measures of quality are altered by improper methods, to that degree our conception of the value of a metal becomes misleading.

How did Teacher Experience arrive at these conclusions? By observing the rate of flow—that is, the degree of plasticity—of a metal in different shaped test pieces. Starting with, say a full sized steel plate of large dimensions, break it and note the stretch in a given length. We get thereby the most reliable measure of the ductility or plasticity of the metal because there was nothing to hinder every particle of the metal adjusting itself under stress according to its nature. Hence we may rightly take the measurements of the functions of the metal thus obtained as a basis or comparison of results obtained in testing the same grade of metal under different forms of test pieces. Supposing we measure the ductility of the steel, while tested in the whole plate, in a length of 8 in. and get as a result 20 per cent. Then we cut up that plate, supposing it still intact, into pieces of various forms, widths and lengths. On testing these pieces we would get a greater per cent of elongation in every piece than that obtained in testing the whole plate. How can that be, do we ask? Does the metal stretch more in short sections than in long ones? Does its plasticity, its pliability, increase with the decrease in distance between fixed points? Ah well, says Science who has been a silent listener, thus far it is just here that the engineer is apt to get a wrong impression. He takes a piece of metal, prepares it as he thinks best, tests that piece of metal, and from the results draws the conclusion that he is using the most reliable measure of quality for that metal. The act of testing, say a piece of steel, consists of four distinct stages. The first stage includes from the time the load is applied to the point when the elastic limit is reached. If you stop loading at that point do not go beyond it, you may load and release the load, and reload many millions of times without hurting or endangering your structure, always provided you do not pass the elastic limit.

The second stage in our testing is included in passing the elastic limit and reaching the yield or breaking down point. This period is the critical stage of a structure, because during that period the metal must show how long it can resist the extraneous forces which try to destroy it before it yields and stretches with a start. The length of the period between elastic limit and yield point is variable, even in the same grade of metal, and seems to depend on the physical condition as produced by the mechanical treatment more than anything else.

The third stage begins with the passing of the yield point and ends on reaching the point of maximum load. During this stage the metal stretches uniformly all over, and the criterion of a good metal is the uniformity of stretch in every part of the test piece wherever it is not hindered by shoulders, corners or the grips of the testing machine. However, the total amount of stretch during the third stage of the active life of a metal is not more than one-fourth, or even less, of the final total elongation.

The fourth and last distinctive stage of testing includes the period of most extensive stretch from the point of passing the maximum load to the point of rupture. During this stage the load decreases steadily until finally fracture takes place at the weakest point. The duration of the fourth stage is proportional to the size of section at the point of fracture and depends primarily on the strength with which the particles of the metal hold together and their plasticity or ability to stretch before letting go of each other.

Could Science tell us what, if any, relation exists between either one or all of the four stages described, and the method of testing, or the form and size of test section respectively? The testing of a full sized beam, plate, axle, tire, eye bar, etc., is the most satisfactory manner of testing, because of the quantity of the metal in the part under stress, which quantity allows the distribution of the strains over a large area or section of the total metal and permits each particle or crystal to take part in the work of resisting the efforts of the extraneous forces to pull the metal apart. Thus each particle has a chance to support its neighbor, the degree of plasticity or flow peculiar to the grade of metal under stress is free to exert itself, stretch takes place all over the sectional area, hence is representative of the true ductility or plasticity of the metal, and fracture finally takes place by a gradual, natural letting go by the particles of each other, by sliding past one another before final and complete separation.

Be it understood, though, says science, that in the foregoing explanation we have omitted to take the element of time into consideration. If, by short and narrow test pieces, by fillets and corners, we hinder and interfere with the free and natural movement of the particles of metal to be tested, if the number of particles taking part in the work of resistance is proportionally very much smaller to the load applied to tear them apart than the number of particles is in proportion to the load pulling at the full-sized beam, axle, etc., then the particles in that illy proportioned test piece are forcibly torn apart before they have had time to stretch and slide according to their nature, and we then get as a consequence of our interfering with the natural plasticity or flow of the metal a higher strength as a result of this violently tearing the particles from their positions. In other words, we have imposed artificial restrictions on the natural development of the first three stages in the destruction of a metal. If the section of the metal in which stretch takes place has not sufficient metal beyond that portion of the test piece where rupture will take place for the free movement of the particles of the metal, then each of the four stages of testing is interrupted and interfered with, giving as a consequence a more or less fictitious value, showing characteristics different from those shown by the whole plate or beam, etc., where the greater amount of metal permits a greatly larger number of particles to take part in the work to be done.

For this reason the so-called groove section, which is formed by a circular notch on either side of the test piece, is the most deceptive measure of quality of any test section, for in that section no flow can take place beyond the grooved portion of the test piece, as a consequence of which the metal is forcibly torn apart on the line of the deepest part of the groove, making the metal appear stronger than it really is, and appearing more ductile, because stretch takes place and can be measured only at the point of fracture, where stretch is greatest under all circumstances. Hence, say Science and Experience, the largest size test piece should be used consistent with the demands of Economy.

A few results of tests given below will illustrate better than any words the remarkable difference between the extremes of modern test section, where the 8 in. section comes nearest the natural conditions of the full sized plate or structural member, while the 1 in., or groove section, is furthest from it, hence giving fictitious values. While a test section where elongation is measured in 10 or 12 in. would be still nearer to the ideal, the difference between these and an 8 in. length is so small that it can be omitted in practice, saving thereby a good deal of metal and cost of preparation.

Elongation with Geometrically Dissimilar Test Pieces.

Per Cent.

2½x½ in.	1½x½ in.	½x½ in'	In Inches.
67	61	55	1
50	43	40	2
36	31	30	4
30	26	26	6
27	24	23	8

Tensile Strength.

Test section, 1½x½ in.

Length of section in inches	1	2	4	6	8
Pounds per square inch	72,000	65,100	62,700	60,300	59,000

COMPRESSED AIR EXPLOSIONS NOT DANGEROUS.

The application of air, compressed to a high degree, to air motor cars has caused some uneasiness with regard to what might occur in connection with explosions of the receivers containing the supply and under the caption "Danger of 2,000 Pounds Air Compression" the American Machinist printed the following in a recent issue:

The use of compressed air for street car propulson is being industriously deprecated in some quarters in advance of its employment. It is hardly time yet for anyone to be much frightened on this score. It is at least best for the

*From the Iron Age.

general peace of mind of the community that only reasources of alarm should be drawn from, and this is not one. If compressed air is to fail it will not be on account of the disastrous explosions that occur in connection with it.

It may be safely asserted that under any conditions that are likely to prevail, a steam boiler with 100 lbs. of steam is vastly more dangerous than a receiver of compressed air charged to a pressure of 2,000 lbs. No one now thinks of a locomotive as being always ready to blow up, and indeed, quite likely to do so without a moment's warning, although one has occasionally scattered ruin and destruction around; and so it is quite possible that we may yet be able to pat the side of the charged air receiver with approval and confidence.

Whatever danger there may be in connection with compressed air of high pressure must be in the receiver alone, and in the chance of its sudden explosion. The giving out of a pipe or connection could never entail any serious consequences. There would be no scalding steam or hot water to escape. We all know the terror of these, and air is absolutely innocent and harmless where steam if released would scatter wholesale destruction. As to the receiver itself, we know that in the nature of the case every receiver must have been tested, and with a large margin of safety, before it is put to use. About steam boilers we only know that, notwithstanding all the inspection laws, some boilers have sometimes been tested, while most boilers never have been, and under present practice never will be tested for pressure.

The most dangerous time for the compressed air receiver must be at the moment when the pressure is greatest, and this must be when a charging or a recharging has just been completed. From that moment, as the air is used and the pressure falls, the danger point rapidly recedes and disappears. But who shall say where or when is the greatest danger with the steam boiler? The danger with it is always present, and may at any moment be increased beyond endurance. The boiler carries unlimited possibilities of future danger, while the danger with the air receiver is always retrogressive.

But the one essential thing to be remembered in connection with the air receiver is that it does not contain the reserve force that a steam boiler carries in its body of hot water. When the air receiver explodes, the result produced is limited to what the volume of air alone can do, and there is nothing behind the air to follow it up and add it to its work of destruction. With the steam boiler the volume of steam contained is only a portion of the destructive agency that may be released. When a steam explosion occurs there is not merely the boilerful of steam, but much more steam chained in the water, and immediately released and pushing on what goes before. A common form of steam boiler explosion has been the blowing out of the head of a long horizontal boiler, when immediately the body of the boiler is transformed into a sky-rocket, the steam and water streaming out of it and driving it onward with terrific speed and force.

Notwithstanding the great area of discharge, a considerable pressure of steam is maintained for an appreciable period of time by the heat contained in the body of water. It is needless to say that if a head should blow out of an air receiver, nothing comparable with this could occur. The reduction of pressure would be instantaneous, and there would be nothing to maintain the pressure but the volume of air itself. Whatever may be the form of rupture that may occur to the retaining vessel, it means immediate release to the air; while with the combined steam and water there is an accumulated store of force to follow up and tear things still more.

There may yet develop practical objections fatal to the general employment of compressed air for street-car propulsion, although we have as yet no hint of the existence of such features; but whatever the objection may be, we certainly need not regard the danger element as one of them. In fact, the safety of the air system must always be one of its chief recommendations.

Louisville's Railway Facilities.

The simple statement that a city in the United States has added to its railway mileage over 15,000 miles in the short space of less than three years, and that too without laying more than 15 or 20 miles of new track, and without an effort on the part of, or expenditure of one dollar by, its citizens, is as astonishing as it appears incredible, yet such is the fact.

In the year 1893 Louisville, Ky., had only two great railway systems that it could call its own, viz.: the Louisville & Nashville, which is eminently a Louisville line, and the great Pennsylvania system. It now has seven, not to mention the Louisville, New Albany & Chicago, no inconsiderable line of itself, the Louisville, Evansville & St. Louis, the Louisville, Henderson & St. Louis and others. During the period mentioned the Louisville & Nashville and the Pennsylvania mileage have remained practically unchanged.

The new systems acquired are the Baltimore & Ohio, the Big Four, the Chesapeake & Ohio, the Southern Railway and the Illinois Central, aggregating a total mileage of about 15,000 miles.

This astonishing result has been brought about by the absorption by the Baltimore & Ohio of the B. O. & S. W., by the building of a third bridge across the Ohio river at Louisville, thus admitting the Big Four or New York Central system, by the lease of the right of way over the Lexington branch of the L. & N. by the Chesapeake & Ohio from Lexington, and by the purchase at decretal sale by the Southern Railway and Illinois Central of the Louisville Southern and C. O. & S. W. Railways respectively; the last of these transactions, namely, the sale and transfer through the United States supreme court of the C. O. & S. W. to the Illinois Central having been completed on the 25th of July, 1896.

It is of course understood that the city of Louisville has always been able to avail itself of the use of most of this mileage, just the same as it is now able to use Canadian Pacific or any other railway; but the idea is that none of these great systems entered Louisville over their own tracks until within the period mentioned. It is a wonderful record truly.

OUR PATENT RECORD.

(Our record of patents that most interest our readers is compiled regularly by our Washington correspondent with the idea of being a complete index. Space forbids more than the citing of a reference, but the complete specification or drawing of any patent desired will be mailed to any address upon receipt of 10 cents in stamps, and other information in regard to patents will be cheerfully given. Address all communications to our correspondent, Edw. C. Weaver, Attorney and Counselor, McGill Building, Washington, D. C.)

565,421, car truck, John C. Baker, St. Paul, Minn, filed Dec. 21, 1895. Serial No. 572,857, (no model).

565,438, railroad frog, Wm. E. Davin, Edgington, W. Va., filed Oct. 8, 1895. Serial No. 565,037, (no model).

565,481, truck bolster, Waldo H. Marshall, Chicago, Ill., assignor to Wm. V. Kelley, same place, filed Jan. 13, 1896. Serial No. 575,277, (no model).

565,559, car coupling, Alexander S. Peck, Armour, S. D., filed Dec. 19, 1893, renewed Jan. 7, 1896. Serial No. 574,648, (no model).

565,653, rail joint or coupling, John H. Williams, Boston, Mass., filed June 1, 1896. Serial No. 593,717, (no model).

565,672, railbond, Fred H. Daniels, Worcester, Mass., filed June 20, 1896. Serial No. 596,276, (no model).

565,689, car coupling, Wm. E. Pearson, Boston, Mass., filed January 2, 1896. Serial No. 574,139, (no model).

565,735, car coupling, Chas. E. Gallanore, Moore, Okla., assignor of one-third to C. B. Haley, Oklahoma, Okla., filed May 5, 1896. Serial No. 590,268, (no model).

565,754, railway switch, Ethelbert L. Kern, Denver, Colo., filed Dec. 21, 1895. Serial No. 572,874, (no model).

565,755, railroad switch, Ethelbert L. Kern, Denver, Colo., filed Dec., 23, 1895. Serial No. 573,174, (no model).

565,801, plate for railway rails, Chas. J. Schenck, Gila Bend, Ariz., assignor of one-half to Adolph C. Langlotz, San Simon, Ariz., filed March 12, 1896. Serial No. 582,889, (no model).

565,835, stock car, Robert C. Burke and Reuben P. Wissler, Brady Island, Neb., filed June 29, 1895. Serial No. 554,432, (no model).

565,870, car axle box, Hamilton E. Welsh, Columbia, Pa., assignor of one-half to W. H. Long, same place, filed Dec. 27, 1895. Serial No. 573,712, (no model).

TECHNICAL MEETINGS.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its in formal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the fourth Wednesday of January, March, April, September and October, at 10 a. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West hirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, n the second Tuesday of each month.

he Engineering Association of the South meets on the ond Thursday of each month at 8 p. m., at the Cumber d Publishing House, Nashville, Tenn.

nual meeting Traveling Engineers' Association, Minneapolis, Minn., Sep. 8, 1896. W. O. Thompson, secretary 415 Marion street, Elkhart, Ind.

Annual Convention Roadmasters' Association and Road and Track Supply Association, Cataract Hotel, Niagara Falls, N. Y. second Tuesday in September, 1896.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnstone, 1522 Monadnock building.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at he Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

PERSONAL.

Mr. E. A. Baty, trainmaster of the Colorado Midland at Leadville, has resigned.

Mr. H. M. Boykin has been appointed general agent of the Seaboard Air Line at Richmond, Va.

Mr. Lewis Grant, freight solicitor of the Lake Shore, has had his title changed to traveling freight agent.

Mr. W. H. Cogswell has been appointed traveling passenger agent of the Toledo, St. Louis & Kansas City.

Mr. R. H. Vaughn has been appointed commercial agent of the Missouri, Kansas & Texas in St. Louis, succeeding C. H. Morrill.

Mr. J. R. King, a conductor on the Mexican Central, has been appointed trainmaster on the Interoceanic Railway of Mexico.

Mr. Joseph Brinker, assistant general freight agent of the Rio Grande Western, has sent in his resignation and it has been accepted.

The appointment is announced of Mr. Walter M. Hoag as car accountant of the West Shore, to succeed Mr. W. W. Wheatley, resigned.

—The railroad commission of Ohio has appointed Mr. Clay M. Runyan statistician of the department, to succeed Mr. Chas. Moore, deceased.

Mr. Ray F. Guerin has been appointed assistant to the general counsel of the Columbus, Sandusky & Hocking Railroad. He is a son of President Guerin.

Master Car-Builder W. E. Looney, of the Louisville, Evansville & St. Louis, who resigned, has been succeeded by Mr. James Gaston, formerly with the Ohio Southern.

Mr. C. Millard has been appointed chief engineer of the St. Louis, Chicago & St. Paul Railroad, with office at Springfield. He will have charge of maintenance of way and buildings.

Mr. J. J. Collins has been appointed secretary of the Central Freight Committee at Chicago, to succeed H. C. Smith, resigned, to accept a similar position with Joint Traffic Association.

Mr. T. E. Blanche has been appointed traveling freight agent of the Northern Pacific, with headquarters at Buffalo. This company is placing representatives at a number of eastern points.

Mr. L. A. Shipman, traveling passenger agent of the Southern Railway, headquarters in Birmingham, has been appointed to succeed Mr. W. D. Allen as Florida passenger agent of the company.

Mr. J. T. Smith, special agent of the Grand Trunk Railway system, has been promoted to the position of claim agent, vice Mr. Thomas Flynn, resigned. Mr. Smith's headquarters will still be at Chicago.

The appointment of Mr. O. O. Ogden, for the last year agent of the Yazoo & Mississippi Valley road at Baton Rouge, as successor to Mr. Wm. Murray, southern passenger agent of the Illinois Central at New Orleans has been announced.

Mr. A. N. Gray has been made chief clerk to Vice-President Finley, of the Great Northern, vice W. H. Hill, promoted. Mr. Gray has been in the employ of the road for a number of years and for some time past has been chief clerk of the Eastern Minnesota.

Mr. H A. Wilson, district passenger agent of the Hocking Valley road has tendered his resignation to take effect on the 15th inst. He will be succeeded by Mr. A. J.

Richter, who though only twenty-nine years of age has seen fourteen years of railway service.

Mr. C. T. Geddes has been appointed general manager of the Toledo, Bowling Green & Fremont electric line. He is now general manager of the electric lines of Kokomo. Mr. Geddes for many years held official position on the Pennsylvania lines in its mechanical department.

Mr. George B. Hazelhurst, who recently resigned as general superintendent of motive power on the Baltimore & Ohio, has become a partner in the construction firm of Jones, Pollard & Company of Baltimore. He is at present engaged in superintending the construction of an aqueduct bridge at Northboro, Mass.

A number of changes have just been announced in the Hoosac Tunnel Fast Freight Line. The agency at Toledo is abolished; Mr. A. G. Marshall appointed contracting agent at Cincinnati; Mr. G. C. Semple contracting agent, Louisville; and Mr. F. E. Browne, agent, St. Louis, transferred Kansas City.

Mr. R. B. Childs, assistant ticket receiver of the Pennsylvania lines at Indianapolis, Ind., has been appointed district land agent of the Illinois Central, with headquarters at St. Louis, effective Aug. 15. Mr. Childs has been with the Pennsylvania Company for some years, and is a young man of considerable ability.

Mr. A. N. Dale formerly manager of the Illinois Central elevators in New Orleans, has assumed the duties of assistant freight agent of the Illinois Central at Memphis, Tenn., entering the office of W. F. Meath, freight agent of the road, whose jurisdiction has been extended to embrace the Chesapeake, Ohio & Southwestern.

Mr. A. L. Woolf, receiver of the Kansas Midland Railway, has appointed Mr. W. P. Homan general manager for the receiver with headquarters at Wichita, Kan. Until further notice the St. Louis & San Francisco Railroad Company will continue to operate the Kansas Midland Railway and have charge of the transportation and traffic matters connected with it.

Mr. F. C. Gay, who resigned as general freight agent of the Atchison, Topeka & Santa Fe in 1895 to accept a similar position with the California Southern, has returned to the former road where he practically succeeds himself, as no appointment was made to fill the vacancy caused by his leaving the service. Mr. E. Chambers succeeds Mr. Gay as general freight agent of the Southern California road.

Mr. James W. Wood, who has been in active service on the New York Central road for forty-five years has been retired on a pension. He first served as a locomotive fireman between Syracuse and Auburn. For years he was known as Commodore Vanderbilt's engineer. March 1, 1876, he made a run with Commodore Vanderbilt from Buffalo to Syracuse, 158 miles, in two hours and forty-five minutes.

Mr. F. E. Ward, formerly secretary to President Hill, of the Great Northern road has assumed the duties and title of assistant to the president. Although his actual duties are not changed to any great extent, his authority is enlarged and strengthened. Mr. Ward entered the Great Northern service a few years ago in a humble capacity, but his capability and fidelity have been appreciated handsomely by Mr. Hill.

Mr. H. R. Dill, trainmaster of the Illinois Central at Clinton, Ill., has been appointed superintendent of the Freeport Division, succeeding W. J. Harahan, transferred. Mr. Dill, was formerly superintendent of the Huntington division of the Chesapeake & Ohio, a difficult piece of road to handle, where he did much good work. Later he became superintendent of one of the divisions on the Central Railroad of Georgia. There was a change in the management, and he went with the I. C. three or four years ago.

Mr. J. B. Flanders has been appointed general superintendent of the Cincinnati, Jackson & Mackinaw. Mr. Flanders began railroading when 15 years old on the Ohio & Mississippi as water boy. In 1869 he was made conductor and given charge of a train on the Vandalia, which he ran until 1879, at which time he went west to accept a conductorship on the Missouri Pacific. In 1885 he was appointed division superintendent of the same road after having served some time as trainmaster. This position he resigned to take charge of the operating department of the Cincinnati, Jackson & Mackinaw.

At Roanoke, Va., this week occurred the death of Mr. A. C. Hippey, general superintendent of the Norfolk & Western road. Mr. Hippey began railroad work in 1876 with the Northern Central and Baltimore & Potomas roads, and occupied various positions in the mechanical departments of these roads and the Philadelphia, Wilmington & Baltimore and Philadelphia & Erie until 1890, when he was made superintendent of the Altoona division of the Pennsylvania. He remained here, however, but six months, when he was made assistant general manager of the Norfolk & Western, afterward becoming general superintendent, which position he has held for the past five years.

RAILWAY NEWS.

Carolina, Tennessee & Ohio.—About 6 miles of the Carolina, Tennessee & Ohio line, between Southport and Wilmington, have been graded and several bridges are now under construction. The line will be a little more than 26 miles in length, running from El Paso to Town Creek, and it is expected to complete it by the last of November. Frank H. Blodgett, whose present headquarters is at Wilmington, is general contractor, and Walter G. McRae chief engineer.

Chester & Lenoir.—At a recent meeting of the stockholders of the Chester & Lenoir Railroad, Mr. A. G. Brice of the bondholders' committee stated that the work of reorganization was proceeding as satisfactorily as could be expected, but nothing had developed to alter the original programme of the reorganization committee; that the holders of $250,000 worth of the bonds of the company had agreed to go into the reorganization and that if they succeed in getting possession of the property without having to pay more than the amount of their bonds, they propose to allow the stockholders 50 cents on the dollar for their stock. This plan, he added, appeared to be satisfactory to every one concerned, and he did not think it probable that the reorganization arrangements would meet with any serious opposition. The report of the receiver, Mr. G. W. F. Harper up to January last was also submitted and shows that the gross earnings of the road amounted to $15,000 more than for the preceding year.

Chicago, Hammond & Western.—The first train was this week run over the Chicago, Hammond & Western, the new belt line built and operated by the G. H. Hammond Packing Company, and extending from the lake to Blue Island, Ill. This new line connects with all the trunk lines running into Chicago from the south and west, and will be made one of the leading belt lines of Chicago. By the use of this line the packing company claims it can save several thousand dollars annually in switching charges.

Chicago, Paducah & Memphis.—This road which extends from Altamont, Effingham county, to Marion, Williamson county—a distance of 97 miles—has passed into the control of the Chicago & Eastern Illinois. Under the name of Shelbyville Southern, a company has been incorporated to build a link of 20 miles to connect a branch which the Chicago & Eastern Illinois already has into Shelbyville with the new acquisition. By extending the road from Marion, its southern terminus, about 35 miles, the company would reach Cairo and secure a connection with the Mobile & Ohio, and the St. Louis Southwestern and other roads.

Cleveland, Lorain & Wheeling.—The contract for relining Fairport tunnel in Belmont county with stone and brick masonry has been let to L. G. Hallock, of Wheeling, W. Va., to be completed within 60 days. The tunnel was built in 1879 and lined with timbers which are now to be replaced with stone sidewalks and brick arch. Length of tunnel 475 ft.

Detroit & Mackinaw.—The grading for the Detroit & Mackinaw R. is fast approaching completion. The line is 32 miles long and begins at Omer, extending southwest to Bay City. The tracklaying, ballasting and other construction work is going on rapidly on all sections except near Bay City. At the Kawkawlin river crossing embankments have been thrown up both sides of the river, and in a short time pile driving for the new bridge will be commenced. Some delay has been caused by condemnation proceeding, but the expectation is to have through trains running by September.

Greenwood, Anderson & Western.—The Carolina Midland road between Allendale and Seivern, S. C., has been acquired by the Greenwood, Anderson & Western, a distance of 60 miles. This road has now under construction an extension from Seivern to Batesburg, where connection is made with the Southern Railway. This division will be finished by Sept. 1 of the present year, giving a completed line between Allendale and Batesburg of 78 miles.

Kanona & Prattsburgh.—Plans are now being discussed for extensions to the Kanona & Prattsburgh road from Prattsburgh north to Stanley or Penn Yan, N. Y., and also from Kanona southwest to Hornellsville. The present line is 12 miles in length and extends between the two towns named in its title. Several routes are proposed for the northern extension, the line to Stanley being 25 miles long, with light grades, and that to Penn Yan, two miles less in distance, but involving some heavy grades. Considerable right of way is already promised. Should it go to Penn Yan, which is the larger town, connection would be made with the Fall Brook line and also with the Northern Central. J. G. Baker, of Prattsburgh, is chief engineer.

Lake Superior & Ishpeming.—This road which was begun in December of last year, is now practically finished, the first train load of ore being shipped from Ishpeming to Marquette the latter part of this week. All bridges are in place and ballasting has been done. An agreement has been entered into with the Chicago & Northwestern Co. to transfer ore from the Lake Angeline and Cleveland Cliffs mines to railroad yards at Cleveland, location one mile from the terminus of the road. The new company has 400 ore cars and a half dozen engines to begin work with. The length of the road is only 19 miles, but has involved some heavy work in grading, and one important iron bridge, that over Dead river, being 430 ft. long. Mr. W. S. Mather, of Cleveland, is president and Mr. S. S. Neff, of Marquette, chief engineer.

Middle Tennessee & Alabama.—It is stated that the Middle Tennessee & Alabama R. Co. has succeeded in selling $735,000 in bonds, and that arrangements have been made for completing the road, which is now under contract between Shelbyville, Tenn., and Decatur. All the tracklaying except a few miles in Tennessee is completed on the first division of 30 miles south of Fayetteville, Tenn. The second section, from Madison Cross Roads, a station on the East Tennessee, Virginia & Georgia near Huntsville, to Decatur, Ala., 23 miles, will be finished by October next. Most of the grading for this line was done three years ago by the Decatur, Chesapeake & New Orleans, and the chief work so far done by the new company has been to surface up the old roadbed and to put down new ties on the portion on which the track has now been built. More than $760,000 has been spent on the construction work, and, in addition to 40 miles of rails on hand, the new company came into possession of three locomotives and a number of platform cars.

New York & Greenwood Lake.—The renewal of the lease by which the Erie road controls the New York & Greenwood Lake has been signed and executed, and the latter will hereafter be known as the Greenwood Lake division of the Erie. The Erie has agreed to pay the fixed charges of the company, which amount to 5 per cent on the funded debt, aggregating $1,500,000 the interest charges being thus an annual rental of $75,000. Important improvements will begin immediately on the line including the building of the second track to Montclair, N. J., and perhaps beyond that town.

Queen Anne's.—The Peninsular Construction Company of Baltimore, has completed nearly 35 miles of the Queen Anne's road which is to cross the peninsula between the Chesapeake Bay and the Atlantic ocean. This road when completed will be 60 miles in length extending from Queenstown, Md., to Lewes, Del., and will be an important factor in drawing more of the trade of this section of Maryland and Delaware to Baltimore, as a line of fast steamers is to be operated on Chesapeake bay in connection with it. The contract for the last 20 miles, that from Lewes westward, will be let within 60 days, and the whole line will be completed and in operation by January 1 of next year.

Sebastian & Cincinnatus.—The grading on the 10 miles of road being built under the name of the Sebastian & Cincinnatus between the two towns named, the former a station on the southern extension of the Florida East Coast, and the latter a new town in the interior of Brevard Co., Fla., is completed, and tracklaying will begin as soon as the ties are down. The line is being built to reach a tract of 100,000 acres of land in the interior of the county, owned and being developed by A. O. & W. W. Russell, of Cleveland, Ohio, and others. This development plan includes the building of 32 miles of irrigating canal.

Wisconsin Northern.—The grading on the Wisconsin Northern, which when completed will be a part of the Chicago & Northwestern, is finished and tracklaying has begun. The new line is to run from Gillett to a connection with the Minneapolis, St. Paul & Sault Ste. Marie near Cavour. The contemplated length of the line is 63 miles, but it is not certain that the entire new road will be built the present season. Over 700 men are now working north of Gillette, and the tracklaying has been commenced. The line goes through forest almost its entire length.

NEW ROADS AND PROJECTS.

Arkansas.—On July 27 articles of incorporation were filed at Little Rock, Ark., for the Sand Creek & Sulphur Springs road, to be built from the crossing of the Mississippi & Malvern road and Sand Creek and Sulphur Springs, all in Jefferson county. The incorporators are N. T. White, Pine Bluff, Ark.; Frank Kendall, M. F. Williams, George McLeod, of Kedron, Ark., and Ed McGann, of Brooks, Ark. Capital stock $20,000.

British America.—Work on the first section of the Hudson Bay road is to begen as soon as a sufficient force of men can be raised. In the country through which the road passes it is said to be impossible to hire but a few men for such work, although the region is quite thickely populated and it has been found very difficult to secure the necessary men from the states at the wages the company desires to pay. This first section extends from Gladstone, Man., to Lake Dauphin, a distance of 112 miles, and it is said to be the intention to push another extension 150 miles from Lake Dauphin to Grand Rapids, on the North Saskatchewan river, via the narrows between Lakes Winnebegosis and Manitoba. When Winnipeg is opened to Hudson Bay by this line the route to England from the Northwest will be materially shortened. It is believed that much of the flour and grain will be shipped by this route, thus resulting in a saving in freight rates.

Illinois.—Articles of incorporation have been filed in Illinois, for a company, which is to construct a road called the Shelbyville Southern, which will form a connection between the Chicago & Eastern Illinois at Shelbyville and its recent purchase, the Chicago, Paducah & Memphis at Altamont. The surveys are already made, and it is expected that the road will be completed by December 1. Contracts have already been let, and projectors will begin work as soon as the right of way is secured. The incorporators are: Don R. Patterson, Henry J. Messing, J. P. Reeves, B. A. Smith and E. H. Seneff, of Chicago.

Indiana.—It is reported that a secret survey for a railroad between Muncie and Richmond is being made by Messrs. Charles Rattiff a former civil engineer for the government, and George O. Cromwell formerly one of the proprietors of the Indiana Iron Works. It is thought likely that the road will be the much talked of link that will give the Panhandle Company a swing at Muncie factories, and a more direct line between Cincinnati and Chicago, connecting with two divisions of the company at the above named terminals, and it is also hinted that the road will be surveyed northwest of Muncie to Marion or Jonesboro.

Louisiana.—It is said that considering the size, no state is making better progress in railroad construction than Louisiana. The New Orleans Picayune tells of a railroad which is about being started, which promises to become one of the important lines of the state, a line to be owned and operated, built and controlled by Louisiana people. This road at present is a very short line known as the Mansfield tap

line, running from Mansfield Junction, on the Texas & Pacific, to Mansfield a distance of only two miles. This road is to be extended from Mansfield to Coushatta, a distance of about 20 miles, and into one of the most prosperous sections in the state. The Mansfield road has been in existence for several years, having been built by the Mansfield people in order to get a connection with the Texas & Pacific proper. This line it is said, has now been bought by capitalists, behind whom the Texas & Pacific is generally reckoned as backers, and the extension will begin in a few weeks. There is a great deal of cotton produced in that section, and there is absolutely no means of having it marketed, only when the rivers are up and water navigation is possible. But there is little dependence to be placed in water navigation, and the people all along through that section of the country are understood as being willing to vote a tax for the building of the road. The original plan of the first promotors of the enterprise was to extend it to Natchez, Miss., and in future this may result from present activity.

Pennsylvania.—A road one mile in length to be called the McKeesport Terminal is to be built from the terminus of the Pittsburgh, Virginia & Charleston, in the city of McKeesport along the south shore of the Monongahela river to the Pittsburgh, McKeesport & Youghiogheny. It will be built by the Dewees Wood Co., of Allegheny giving an outlet for the products of that company and traversing the property of the McKeesport Gas Co. Richard M. Wood of Allegheny is president. Capital stock $100,000, commencing with $10,000.

Tehauntepec.—A press dispatch under date of August 11 from San Francisco says: "An English syndicate at the head of which is Sir Whetman Pearson, member of parliament for Colchester, has just concluded a lease with the Mexican government of the Tehauntepec Isthmus Ry. The terms of the lease include an agreement on the part of the syndicate to finish works already well advanced for the improvement of the harbor of Coatzacoa at the Atlantic terminus of the road, and to construct the harbor works at Salina Cruz, the Pacific terminus, which were included in the original plans but which the Mexican government has been so far unable to execute. The road itself will be greatly improved and put in the condition of a first class road. A line of ships plying between Salina Cruz and San Francisco will soon be put on and deliver freight to the many lines plying in the Gulf of Mexico. A determined effort will be made to secure the freight and low priced passenger traffic of San Francisco. On the other side of the isthmus it is expected to get the bulk of the European fine freight, such as dry goods, which now come by steamship to New Orleans and by rail to San Francisco."

Texas.—The people of Marshall, Texas, think there is a very good reason why they should have another road. A big strike has been made at Rosborough Springs in the shape of a vein of coal twelve feet thick and twenty feet wide, and how long cannot be determined. It burns well and makes a very hot fire, leaving very little cinders. If developed it will be a very great thing for Harrison county. A great deal of enthusiasm is evidenced and consultations have been held with Mr. W. C. Teter, of Galveston relative to the work. At present all things look favorable.

Wisconsin.—The contract for a new road to be built between South Superior and Allouez Bay, Wis., has been let to Winston Bros. & Dear of Minneapolis, Minn. The surveys are already completed and the length of the line is about seven miles. It is thought the new line is to be a branch of the Great Northern as the surveys were begun at a connection with that line. This would also give it a connection with the Duluth & Winnipeg Terminal at Allouez Bay.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Indiana Pipe Line & Refining Co. has placed an order for fifty 8,000 gallon tank petroleum cars with the Terre Haute Car Works. These cars will be built practically on M. C. B. specifications.

—Five locomotives are under construction at the Brooks Works for the Chicago, Rock Island & Pacific Railway.

—We are informed that the contract for building the 10 Page dump cars, which has been previously assigned to the Madison Car Co., has been actually let to the United States Car Co., and will be built at Hegewich.

—The Illinois Central has contracted for the construction of six 10-wheeled and eight 8-wheeled passenger locomotives, five moguls and four 6-wheeled switchers. This order is divided between the Brooks and Rogers Locomotive Works. There is said to be no truth in the report that additional passenger cars are to be built.

—H. K. Porter & Co. of Pittsburgh has secured a contract for equipping the Eckington & Soldiers' Home street railway of Washington with traction cars and compressed air motors, and it is expected that all the lines in the District of Columbia will be similarly equipped. The new cars will resemble ordinary cable cars and will be about 20 ft. long. The power will be placed beneath the seats and the bed of the car. This will be contained in eight iron retorts 9 in. in diameter, and as long as the car. The air will be maintained at a pressure of 2,000 lbs. to the cubic inch. The air pressure in the storage tanks is reduced through hot water, and the expansion is greatly increased. The power is regulated by ordinary levers, and the system is almost identical with a steam or compressed air locomotive. It is claimed for compressed air that it is economical, absolutely safe, simple and durable. It is convenient in operating and its cost for maintenance and repairs is exceptionally low. Its economy is determined by the first cost of installation of the plant, cost of operating, mileage and tonnage. None of the power is wasted. No pipe line is required to carry the compressed air to stations along the route, and all that is needed is to place the cars on the tracks and start them.

—The Chicago, Rock Island & Pacific Railway has ordered 100 coal cars to be built by the Michigan-Peninsular Car Co.

—The Hinson Manufacturing Co. has brought suit against Dyer Williams and the Latrobe Steel Co. for infringement of the Hinson patents in manufacturing the Williams coupler. It states that it will also file suits against car-building concerns which have applied these couplers to C., B. & Q. and other cars.

Bridges.

—A levy has been made on the Reading (Pa.) rolling mill on an execution against the bridge building company of Cofrode & Saylor, Philadelphia and Pottstown, and the Reading Rolling Mill Company for $146,561. The works are now idle The execution creditor is the Security Co., of Pottstown.

—The county commissioners at Ellensburg, Wash., have awarded a contract for the construction of a 200-ft. single-span wood and steel bridge, with one 180-ft. approach, at that point.

—A meeting of the stockholders of the Pittsburgh Bridge Co., of Pittsburgh, will be held on Tuesday, Sept. 1, to vote on a proposed increase in capital stock from $25,000 to $350,000. President Moxham, of the Johnson Co., Lorain, O., said last week that his company was very hopeful of being able to average about half time. It is not possible, he added, to predict the outcome of the present business stagnation, although on the whole it was reasonable to look for improvement rather than the reverse. The policy of the company will be to run on orders as received, which will of necessity make the work of the plant somewhat irregular. It is expected that in the 60 days to come the plant will average about half-time.

—Bids will soon be asked for constructing a 180-ft. drawbridge at Green Bay, Wis.; estimated cost, $10,000.

It is stated that the Belt Line Railroad, of Florence, Ala., will construct a new bridge across Sweetwater creek.

—Bids are asked until September 9 for constructing a yellow fir bridge 220 ft. in length, with about 250 ft. of approaches at Nehalem. Ore.

Buildings.

—The contract has been let for the new plan of Block & Pollak, manufacturers of steam forges and car axles, to be built at Carthage, O., to cost $20,000. It will be a steel structure 80 ft. front and 350 ft. deep. The main contract was let to the Cincinnati Iron Works Co.

—It is said that the Louisville & Nashville Railroad will make extensive improvements to its New Orleans depot.

—A new plant will be erected at Port Richmond, Staten Island, N. Y., by the King Drop Forge Co., which will purchase considerable new machinery. The capital stock is $300,000. Lincoln King is president, W. Scott King, vice president; A. Morris Hall, secretary, and Charles H. Ingalls, treasurer.

—It is said that the Illinois Central Railroad Co. will build a big freight depot in Louisville, Ky.

—It is stated that the Erie will remove its large car and repair shops from Salamanca to Falconer Junction, 1½ miles east of Jamestown, N. Y. Large shops will be built, also new machinery of the latest design will be installed in every department, especially for locomotive building for its own use.

—The Louisville & Nashville Railroad Co. has let contract to Dodson & Co., of Atlanta, Ga., at $32,000, for the erection of the new freight depot.

—The Great Northern Railroad Company has given a contract to M. Dow for the erection of a new freight depot at Seattle, Wash., 506x45 ft.

Iron and Steel.

—The receivers of the American Tube & Iron Co., Middletown, Pa., made their fourth payment a few days ago on the company's indebtedness. All creditors whose claims were less than $300 have been paid in full, and interest at the rate of 6 per cent per annum has been paid on all the obligations of the company up to the time of the dates they were due.

—The Allison Manufacturing Co. of Philadelphia, Pa., is making extensive improvements to the flue mill department of its works. Five Duff gas producers, one Herrick regenerative gas bending furnace and one Herrick regenerative gas welding furnace have been installed and these furnaces, with part of the producer plant, have been in operation for some weeks. Another larger welding furnace of the proposed series is now in process of erection. J. A. Herrick of Wyncote, Philadelphia, Pa., is the contractor and engineer for this work.

—The Kansas City Steel & Iron Works at Argentine, Mo., has been bought by a party of Iowa capitalists. The works will at once be enlarged and steel will be manufactured under a new process. The company is composed of J. R. Cline, the discoverer of the process; Mr. Schee, a large property owner; S. H. Springer, inventor of the car coupler, and H. D. Schackelford of Des Moines, a manager of years of experience. They propose to go to work at once and put the goods on the market.

—The United States Car Co. will put all departments of its rolling mill at Anniston, Ala., into operation.

—The incorporators of the new tube works at Greenville, Pa., are F. W. Ensworth, H. N. Shrom, Carl Buck, G. B. Chase and Levi Morrison. The principal stockholder is Henry A. Lozier of Cleveland. The capital stock will be $500,000. The company will manufacture weldless tubing of steel, copper and brass. The mill, now in course of construction, will be one of the largest and most modern in the world.

—The Union Iron & Steel Co. which is operating the lower and upper mills at Youngstown, started the Warren mill a few days since. It is not yet decided when the plant at Girard will be put in operation.

—The Johnson Company has suspended all work upon the four blast furnaces which it contemplated erecting at Lorain, Ohio. No further work will be done upon the plant until an improvement takes place in the iron trade.

Machinery and Tools.

—Some time ago the American Pneumatic Tool Co. entered suit against the New England Granite Works, James G. Batterson, president, in the United States circuit court for the district of Connecticut. This suit was for infringement, damages and profits because of defendant's use of the pneumatic tool marketed by the Pneumatic & Electric Tool Co. On July 27 Judge Shipman signed a decree giving judgment to the American Pneumatic Tool Co. A master has been appointed to determine the amount of damages and profits.

—The Brown Hoisting & Conveying Machine Co. of Cleveland, O.; general eastern office, Havemeyer Bldg., New York, has received an order from Fried. Krupp at Esson, Germany, for a complete hoisting and conveying plant for his blast furnace at Rheinhausen. This plant consists of three standard Brown overhead bridge tramways, to be operated by electricity, each machine having independent winding drums and electric motors. The Brown Hoisting & Conveying Machine Co. is to furnish all the working parts, including the sheaves, engines, motors, hoisting and conveying machines, etc.; in fact, every thing but the bridges proper, which will be built in Germany, the Brown Co. sending a man abroad for that purpose. There will be three Elwell-Parker motors used of about 60 h. p. each. The entire plant is to be in operation by the early part of 1897.

—Lea & Carroll of Pittsburgh has contracted to furnish the Schoen Manufacturing Co. a 12x12 McEwen engine, direct connected to a 50 kilowatt dynamo for operating electric cranes and for lighting the mills.

—The Davis & Egan Machine Tool Co. of Cincinnati, at a recent meeting of the board of directors, declared a dividend of 3 per cent for the past three months. The company reports an unusually good business, the July sales being larger than those of any month this year.

—Work has been commenced on the installation of 6,500 horse power Cahall water tube boilers at the Edgar Thomson Steel Works, Bessemer, Pa. These are being furnished by H. E. Collins & Co. of Pittsburgh, sales agent for this type of boiler, which is manufactured by the Aultman & Taylor Machinery Co., Mansfield, O.

—Mr. E. S. Taber, president and treasurer of the Morse Twist Drill & Machine Co. of New Bedford, Mass., writes that in a general way the entire manufacturing department of that concern is being improved by the introduction of new and modern machinery which is being added to the plant. The establishment is taking a more advanced position each year with reference to the accuracy and reliability of the tools used and the work turned out.

—The Hancock Inspirator Co. of Boston has issued notice that Mr. William S. McGowan, Jr., has been elected treasurer of that company, vice Edward P. Noyes resigned. Mr. McGowan has had large experience in the handling of mechanical appliances, he being formerly with Manning, Maxwell & Moore of New York, Mr. McGowan is full of energy and will vigorously push the products of this company.

Miscellaneous.

—S. Freeman & Sons, Racine, Wis., has a contract for furnishing 1,000 ft. of 34 in. wrought steel delivery pipe for dredge work, together with 2,000 ft. of 30 in. air tight steel pontoons for floating the delivery pipe. It is for a government dredge at Cairo, Ill. The pipe and pontoons will weigh over 200,000 lbs.

—The Houston & Texas Central Railroad Company is experimenting with an electric headlight for its locomotives, and it is probable that all of the engines on its road will be equipped with this light.

—The Phosphor Bronze Smelting Company, Philadelphia, has recently secured the right to manufacture Delta metal in the United States. It is now placing it on the market in rods, plates and heavy castings.

—The National Switch & Signal Co. has been awarded the contract of installing 46 sets of block signals for the Ulster & Delaware Railroad.

—The new and large works of the Q & C Co., manufacturers of railway supplies and special machinery, which has recently been erected at Chicago Heights, a suburb of Chicago, is kept quite busy on orders for the well-known goods made by this company. They have recently secured orders for six large metal sawing machines, a number of which will carry saw blades 36 in. in diameter, and all but one of these machines are to be run by electric motors. The Bryant patent metal saw, as manufactured by this company, requires such a small amount of power to operate successfully that there is a growing demand for these machines equipped with motors, as the saving in actual cost for operation is considerable, at the same time giving equally efficient results.